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At 9:30 o'clock, the hour for the meeting of the Railway Signal Association to begin yesterday morning, it looked as if the claims of the advocates of Chicago as the permanent location of the annual meeting were not founded on facts, especially as to the probability of securing a greater average attendance in Chicago than anywhere else. There were less than a score of members in the room, and not many more a half hour later. But they came in so rapidly in the next hour or so that at 11 o'clock the attendance was fully up to the standard of the average Chicago meeting, and by noon the room was well filled. It is to be regretted, however, that more careful attention was not paid to the opening hour, for some of the members missed parts of the discussions in which they were interested, and by their absence prevented the committees which reported during the first hour or so from profiting by the suggestions and opinions of a representative number of those who will pass upon the final reports.

A circular accompanying the advance notice of yesterday's meeting announced the publication, on or about June 15, next, of the Railway Signal Association's manual of recommended practice, on which the committees have been working for some time. The form in which it is to be put out is designed for the greatest convenience in practical use, and in keeping the manual up to date by the insertion of the new recommendations as fast as they are approved. The manual will fill a long-felt want. One of the reasons, perhaps, why the R. S. A. standards have not been more rapidly adopted by signal departments has been the difficulty of referring to them. It is true that it isn't much of a task to look them up in the Journal, or keep a list of them in the office. But some departments don't keep their journals complete, and lists get lost; and it is then just enough of a task to find the standards to prevent their being looked up, especially if an easier way is at hand, such, for example, as a catalogue number. The manual is also going to be of considerable value to the association itself in the way of helping the members to form an idea of the work in the aggregate. This is the first time the association's work has been gathered together, and it will undoubtedly be a pleasant surprise to many members to see how much of it there is and how

well it has been done. If the manual is considered as representative of signaling practice, as it will be considered, some weak places will undoubtedly be found, and some standards will appear in their true light as unimportant parts of the ensemble, however valuable they may be in certain specific applications. Seeing the standards in perspective will show better than a study of them separately how substantial a basis has been formed for future work, and what will have to be done to make the whole structure what it should be. The manual is, in a word, a decisive step in the progress toward the time when signal departments can and will universally specify "R. S. A."

The committee on Definitions promises a complete report at the June meeting. Its work has been sub-divided, and the report will cover four kinds of definitions, namely: (1) those of words, terms and phrases peculiar to and used in signaling which have not previously been defined by the association; (2) those of words, terms and phrases which have been adapted to signaling from other lines of work, such, for example, as those employed in connection with the use of alternating current; (3) those of certain words, terms and phrases which have been either improperly defined or improperly applied; and (4) a complete list of the definitions available from these and other sources which can properly be included in the Signal Dictionary. In taking up the work along these broad lines, the committee has evidently put a liberal interpretation on its instructions to prepare definitions for technical terms connected with signaling, with particular reference to terms "which discussions show are not properly defined." But if the intention was to limit its corrective efforts to such definitions as have been formally adopted, the committee would not have much to do, for the Signal Association has not approved very many definitions to date. So, the liberal interpretation would seem to be the proper one. Definitions are based on meanings, and meanings are governed by use. Most technical terms may be considered, therefore, as already defined in a general way by their commonly accepted application. But a good many of them are not correctly used, and thus are "not properly defined." Signaling has borrowed a number of words from allied lines of work; and where it could not borrow has had to invent both new words and new meanings for old ones. Some of the borrowed words have proper applications; others have not. Some of the coined phrases are expressive, and some are arbitrary. Some of the old words fit nicely into their new uses, but others are wrongly applied, a notorious example being the term "failure." The committee's report covering all of these matters is sure to be interesting and, if the discussions following its presentation shall lead to a more satisfactory use of words in signaling, the work incident to the committee's liberal interpretation of its instructions will have proved worth while.

MANUAL BLOCK.

The substitution of the space interval for the time interval is likely to proceed at a much more rapid rate in the near future than it has for many years. The Missouri Pacific's recent installation of 3,000 miles of manual block signaling is significant of the general attitude toward safer methods of operation. Federal legislation requiring the use of the space interval seems probable. A block signal bill is now pending in Congress. In one state, the use of the block system is already compulsory, and it is likely to be made so in others.

As a matter of fact, the extension of the block system, aside from the increase in the mileage protected by automatic signals, has not been very rapid during the last decade. One year even showed a decrease, though that was the result of the replacing of manual blocks with automatic, without an increase in the total mileage protected, and not of abandonment of the manual. Considerably more attention has been given to improving what was already in use rather than to extending it to a greater number of miles.

Under the spur of impending legislation and public opinion, however, and the necessity of avoiding repetitions of the unfortunate conditions which lately turned the attention of the public to the question of safety, the block system will undoubtedly be rapidly extended from now on. It is almost a case of "put it in now or be made to, later."

The adoption of the space-interval system on a large scale will probably mean the installation of some form of manual block on most of the mileage to be protected. Automatic signaling, though less costly now than formerly, especially in its applications to electric roads, is still too expensive for all lines. Thus, the manual block, as a subject for the Signal Association's attention, is likely soon to have a new interest, and before long may even be found at the head of the list of timely and important matters for committee work. Last year the committee on Manual Block failed to submit a report at the annual meeting. The start made this year under Mr. Steven's leadership is gratifying, and indicates that the final report will bring out some valuable information on a subject concerning which there has long been too little known. The investigation as to the relative advantages, safety and cost of the manual, controlled manual and staff systems, which the committee was instructed to make should prove especially interesting.

THE SIGNAL ASSOCIATION MEETING.

Contrary to the custom heretofore followed in Signal Association meetings, only such reports as were published in the advance notice were considered by the members. Those committees that were not represented in the notice were not mentioned specifically, the president calling on them only in a general way. This will spur up the dilatory committees, though it probably was not intended to have that effect, but to permit the committees which do have something to say to take full advantage of the limited time available in a one-day meeting.

Only two matters of much interest were developed by the discussions at the meetings yesterday. One of these was the proper form for presenting the values of operated units, and the other was the proper way to ventilate a relay. The first came out following the report of the special committee on contracts. The committee requested a tentative vote on several propositions relating to the form of the tables, the result being that the meeting favored a subdivision to cover manual and power plants and the including of both maintenance and construction in each. This makes two tables instead of one, but if the vote to shorten the list of units in the tables is put into effect the two can, it would seem, be used conveniently, though some complications may arise in connection with electro-mechanical plants.

The question of proper apportionment of expense at joint plants has been under consideration for a number of years. A settlement of it would help out many difficult situations, and probably go far toward obviating the necessity which some signal departments find occasionally for holding up the bills of another signal department until some minor questions as to the share of expense each shall bear can be argued between them to a satisfactory settlement. The committee will undoubtedly be able to profit by the tentative expressions of the opinions of the members, and the final report will probably more nearly meet the majority opinion. Here, as everywhere, the give-and-take spirit must be shown and an agreement reached between those who think the list should be shortened and the

few who think it ought to be still more specific and detailed.

The sub-committee on relay specifications stirred up a lot of discussion on the ventilation of relays, but nothing developed that will be of any value in completing the report. Several experiences were related, and a number of opinions expressed, but the actual facts are still to be ascertained by experiment and analysis of conditions. It was suggested that signalmen watch their instruments carefully and make note of time, place, and all attendant circumstances whenever they find a relay which shows the effects of the action of moisture. This affords a good way for the members to help the committee, and, though it will involve a little extra work, the results will be so beneficial that the expense and trouble will be well worth while. Where a subject is viewed in different lights by a considerable number and only one or two really have any definite knowledge an agreement will never be reached unless all concerned contribute to it. The suggestion should receive not only consideration but immediate and earnest attention.

PROGRAMME OF AMERICAN RAILWAY ENGINEERING ASSOCIATION CONVENTION.

The following is the programme for the thirteenth annual convention of the American Railway Engineering Association. The programme is subject to change by a two-thirds vote of the convention or by time required for consideration of reports:

Morning sessions, 9:00 a. m. to 12:30 p. m.
Afternoon sessions, 2:00 p. m. to 5:30 p. m.

FIRST DAY.—Tuesday, March 19.

President's Address.
Reports of Secretary and Treasurer.
Reports of Standing and Special Committees.

XII.	Rules and Organization	Bulletin 141
X.	Signals and Interlocking	Bulletin 141
	Minority Report on Signals and Interlocking	Bulletin 141
XV.	Iron and Steel Structures	Bulletin 141
VII.	Wooden Bridges and Trestles	Bulletin 141
XIV.	Yards and Terminals	Bulletin 141
II.	Ballast	Bulletin 141
III.	Ties	Bulletin 141

Adjournment at 4:00 p. m. to visit Railway Appliances Exhibition in the Coliseum.

SECOND DAY.—Wednesday, March 20.

V.	Track	Bulletin 142
I.	Roadway	Bulletin 142
IV.	Rail	Bulletins 143, 144
VIII.	Water Service	Bulletin 142
VIII.	Masonry	Bulletin 143
XIX.	Conservation of Natural Resources	Bulletin 143
XI.	Records and Accounts	Bulletin 143
XVIII.	Electricity	Bulletin 143

Annual dinner at 7:00 p. m.

THIRD DAY.—Thursday, March 21.

XVI.	Economics of Railway Location	Bulletin 144
IX.	Signs, Fences and Crossings	Bulletin 144
VI.	Buildings	Bulletin 144
Special.	Grading of Lumber	Bulletins 133, 144
XVII.	Wood Preservation	Bulletin 144
Special.	Uniform General Contract Forms	Bulletin 145

New Business.
Election and Installation of Officers.
Adjournment.

HOW TO GET TO THE ARMORY AND COLISEUM.

The National Railway Appliances Association has provided four big stage-automobiles for the convenience of railway officials who wish to visit the Armory and Coliseum. These machines will operate on a schedule of about seven minutes headway between the Congress Hotel and the Armory, and are available throughout the day to all members of either the American Railway Engineering Association or the Railway Signal Association. Each car will carry a blue pennant with the letters "N. R. A. A." in white.

ANNUAL MEETING OF THE NATIONAL RAILWAY APPLIANCES ASSOCIATION.

The annual meeting of the National Railway Appliances Association will be held at the Coliseum to-day (Tuesday) at 11 o'clock a. m. in the room at the south end of the building, directly over the Annex. Each exhibitor is entitled to one voting representative. The officers to be elected are president, vice-president, treasurer and six members of the executive committee.

THE SPEAKERS AT THE ANNUAL A. R. E. A. DINNER.

At the thirteenth annual dinner of the American Railway Engineering Association on Wednesday evening, March 20, the following will be the speakers:

L. F. Loree, president Delaware & Hudson and a past president of the American Railway Association; Hon. F. D. Monk, K. C., M. P., minister of public works of Canada; and Ray Morris, a director and formerly managing editor of the Railway Age Gazette. W. C. Cushing, president of the association, will be toastmaster.

The dinner will be held in the Gold room of the Congress hotel at 7 p. m., and will be followed by a smoker.

IMPORTANT POSITION FOR W. S. KINNEAR.

W. S. Kinnear, president of the Kansas City Terminal and one of the founders of the Engineering Association, has been elected president of the United States Realty & Trust Company, New York, effective May 1. This company, in addition to its banking business, owns a large amount of valuable New York real estate, including the Flatiron and other buildings owned by the Fuller Company, which is a subsidiary of the United States Realty & Trust Company. Before going to the Kansas City Terminal, about a year ago, Mr. Kinnear was in charge of the building of the Detroit River tunnel, having resigned as chief engineer of the Michigan Central to become president of the tunnel company.

MINNESOTA COMMISSION ENGINEER ATTENDING CONVENTIONS.

D. F. Jurgensen, chief engineer of the Minnesota railway commission, is here to attend the conventions of both the Railway Signal Association and the Railway Engineering Association. Mr. Jurgensen has been connected with the Minnesota commission for eight years, having been chief engineer since 1908.

CORNELL ALUMNI AT THE CONVENTION.

Cornell University alumni, in attendance at the convention of the American Railway Engineering Association, will be interested to learn that special provision for them to get together has been arranged for. Tables for Cornell men at the annual dinner on Wednesday night have been reserved,

tickets for which may be obtained by addressing H. C. Holloway, of the Rail Joint Company, Chicago. In addition, the Cornell Alumni Association of Chicago desires all Cornell men in attendance at the convention to join at luncheon on Thursday, at 1 o'clock, at the Grand Pacific Hotel. Addresses will be made by F. S. Porter, president; J. G. Sullivan, assistant chief engineer of the Canadian Pacific, representing the railways, and Mr. Halloway, representing the supply men. There are a large number of Cornell men expected to attend the convention, and it is earnestly urged that all make a special effort to be present.

WESTERN RAILWAY CLUB.

The regular monthly meeting of the Western Railway Club will be held on the eleventh floor of the Karpen Building, 900-910 South Michigan Boulevard, on Tuesday evening, at 8 o'clock p. m.

The paper for the evening will be on the subject of "Lubrication of Steam Engines," by Dr. P. H. Conradson, chief chemist, Galena-Signal Oil Company. Dr. Conradson will make practical demonstrations of the lubrication of superheater engines at this meeting. It is hoped that those in attendance at the convention will make special effort to attend the meeting, as the address of Dr. Conradson will be well worth the consideration of everyone.

EXTRA, 5:00 A. M.

Accompanied by Mr. First Robin and Mr. G. Hog, Miss Gentle Spring arrived this morning at the Congress. She said she had come via the Milky Way on a sled. She asked to be shown to her room immediately, as she feared to be abroad in the early morning, and, besides, she was a few hours ahead of her schedule. Timid and retiring, she requested that her early arrival be given no publicity. She did, however, authorize us to publish the following notice: that unless the certain lands, tenements, and hereditaments in which she has a life estate are surrendered to her by to-morrow noon she will start suit in ejectment against one Winter, one March Lion, one Willis L. Moore, et al. She is also contemplating a suit for damages against Father Time and the calendar makers. However, Miss Spring will appear at the Coliseum to-morrow in time for lunch.

THE PERMANENT EXHIBIT IN THE KARPEN BUILDING.

The Permanent Manufacturer's Exhibit of Railway Supplies and Equipment on the twelfth floor of the Karpen building, 900 South Michigan boulevard, is having its formal opening this week. The management has spared no effort nor expense to provide a convenient and attractive place where exhibits of railway supplies may be maintained all the year round for the inspection of railway men on their visits to the city as well as for those who live in Chicago. The booth spaces are uniformly provided with handsome furniture and equipped with steam and electric power, lights, telephones, etc. A large assembly room and committee rooms are at the disposal of railway or supply organizations for their meetings and a club and excellent grill room are on the eleventh floor. A musical programme will be rendered daily this week. The second floor of the building has been set aside for a permanent exhibit of maintenance of way appliances.

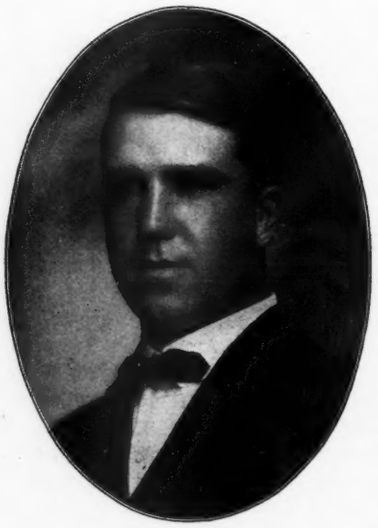
F. D. Monk, K. C., M. P., minister of public works of Canada, who will be one of the speakers at the annual dinner of the engineering association on Wednesday evening, is expected to arrive in Chicago this evening. Mr. Monk will be accompanied by his daughter. It is expected that he will attend some of the sessions of the association.

Proceedings.

The stated meeting of the Railway Signal Association was called to order at 9:45 a. m. on Monday, March 18, in the Florentine room of the Congress Hotel, by the president, C. C. Anthony, assistant signal engineer of the Pennsylvania Railroad.

CONTRACTS.

The committee was instructed to (a) continue preparation of forms of contracts for joint interlocking plants; and (b) prepare table of arithmetical values of operated units.



L. R. CLAUSEN.

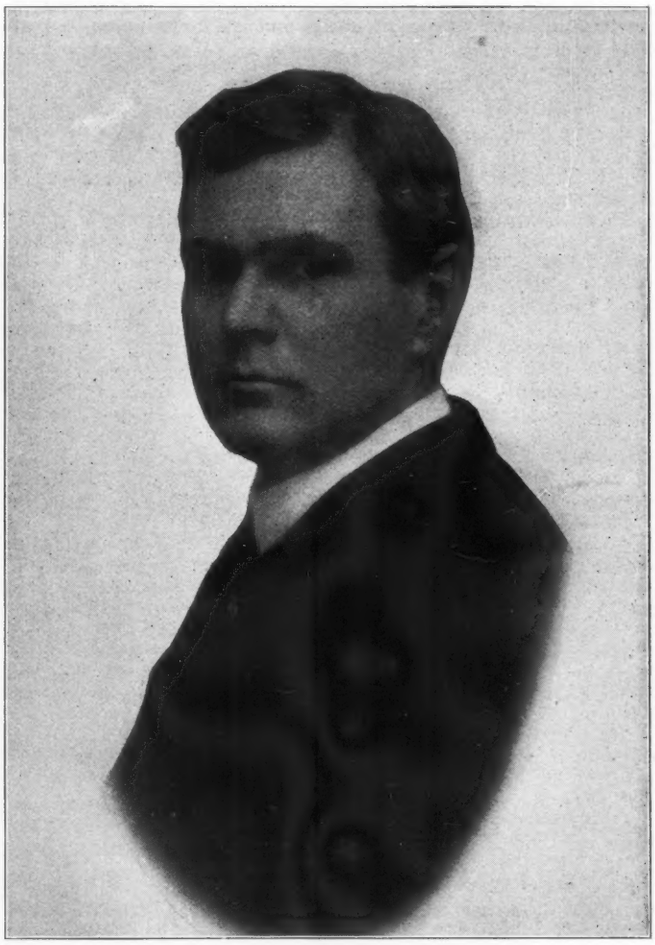
Chairman Special Committee on Contracts.

The committee submitted a preliminary statement of the relative value to be assigned to the various operated units at interlocking plants as follows:

	Manual Plant.		Power Plant.	
	Const.	Maint.	Const.	Maint.
1. Each one-arm, two-position signal.	3.	1.	7.	1.
2. Each additional arm on same mast.	3.	1.	6.	1.
3. Each one-arm three-position signal.	3.	1.	8.	1.
4. Each additional arm on same mast.	3.	1.	6.	1.
5. Each additional fixed arm.....	.25	.10	.25	.1
6. Each fixed one-arm signal.....	1.00	.10	1.00	.1
7. Each two-position power signal on manual plant	8.	2.		
8. Each additional arm on same manual plant	7.	2.		
9. Each one-arm dwarf signal.....	2.	1.	5.	1.
10. Each additional arm on same mast.	2.	1.	4.	1.
11. Each single switch, two points, no levers, bars or locks.....	2.	1.	2.	1.
12. Each single switch and lever, two points; no bars or locks.....	4.	2.	6.	2.
13. Each derail and lever; no bars or locks	4.	2.	6.	2.
14. Each single slip switch and levers; four points; no bars or locks.	6.	5.	11.	5.
15. Each double slip switch and levers; eight points; no bars or locks.	10.	10.	14.	10.
16. Each set movable points, frogs and levers; four points; no bars or locks.....	6.	5.	8.	5.
17. Each detector bar alone; no lever.	0.5	1.	0.5	1.
18. Each switch and lock movement alone	1.00	1.		1.
19. Each facing point lock alone....	.50	1.		
20. Each detector bar on separate lever	3.5	2.	5.	2.
21. Each facing point lock on separate lever	3.5	2.	5.	2.
22. Each facing point lock, with one detector bar, one lever.....	4.	3.	5.5	3.
23. Each facing point lock, with two detector bars, one lever.....	4.5	4.	6.	4.

24. Each two facing point locks, with one detector bar, one lever....	4.5	4.	6.	4.
25. Each three facing point locks, with one detector bar, one lever.	5.	5.	6.	5.
26. Each torpedo placer, one lever...	4.	2.	6.	2.
27. Each drawbridge coupler, one lever	3.	2.	6.	2.
28. Each drawbridge rail surface and alignment; lock and lever.....	3.5	2.	6.	2.
29. Each drawbridge wedge and machinery; lock and lever.....	3.5	2.	6.	2.
30. Each cantilever bracket.....	.25	.10	.25	.10
31. Each telephone circuit and phone.	.5	1.	.5	1.
32. Each switch indicator.....	2.	1.	2.	1.
33. Each outlying switch lock.....	2.	2.	2.	2.
34. Each time release—any kind.....	1.	.25	1.	.25
35. Each tower indicator and control.	1.	1.	1.	1.

C. C. ANTHONY, President.



B. H. MANN, Vice-President.

36. Each electric lever lock with control	2.	1.	2.	1.
37. Each D. C. track circuit, including joints, battery, relay.....	1.	1.	1.	1.
38. Each electric slot for manual signal and control.....	1.	1.		

The committee consists of L. R. Clausen (C. M. & St. P.), chairman; Geo. Boyce (C. St. P. M. & O.), C. A. Christofferson (N. P.), R. L. Davis (M. C.), R. L. Huntley (U. P.), J. B. Latimer (C. B. & Q.), E. B. Pry (P. L. W.), and L. S. Rose (C. C. C. & St. L.).

Discussion on Contracts.

Mr. Clausen: It would perhaps be desirable to have somewhere in our records some mention of the reason for the table of values of operating units. I believe there is nothing at the present time in our proceedings that will indicate why we are so desirous of obtaining such a table of values for maintenance and construction of interlocking plants. The practice regarding the apportionment expense of construction, maintenance and operation of joint interlocking plants has been either to divide this cost according to the number of roads involved, according to the cost of the material assigned to each company, or according to the number of levers in the plant assigned to each company. The first method, the division according to the number of roads, is fair when the same amount of material and apparatus on each road is involved in the joint plant. It is unfair when a different amount of material is involved, when there are, say, three times as many tracks interlocked on one road as on another. This division, according to the number of roads, makes no provision for enlargement of interlocking, and the adjustment according to the number of roads after an enlargement certainly would not be fair, if it were unfair previous to the enlargement. There is some question as to the fairness of dividing the expense for construction and maintenance according to the second method, even if the cost of material which is used on each of the companies' tracks should be equitably determined. It might be a proper and fair division for construction expense, but it would not necessarily be fair for maintenance. At the best such a method of determining expense is a rather rough estimate. It is impractical of determination when you come to enlargements of the interlocking plant. There is so much material that is joint, for use on both companies' lines, that it is a very hard matter to try to divide it up among the separate companies. The amount of time, as well as trouble, involved, is serious. I remember a case when the time and trouble was of such an extent that the interest on the money involved in an enlargement of an interlocking plant was more than the entire maintenance expense of the first year; that is, it took so long to determine what the proper division of maintenance would be that the interest on the many bills held up amounted to more than the entire maintenance of the plant for the first year; and of course the road that made the enlargement was out the interest. The third method, the number of levers, is fair when the same methods of construction are used on the several companies' tracks. It is unfair if there is a different method of construction used on each company's tracks. It would be very easy for one to imagine an interlocking plant where the cost of the equipment on one road's tracks would be twice that on another road's

tracks, and the cost of maintenance might be three times that on another road's tracks, with the same number of levers. This method, though, has an advantage, that it takes care of the enlargements of the plant, and it has been used in a large number of cases with very fair satisfaction. There has recently been felt a need for some other basis of division of expense of construction and maintenance which would more nearly represent the actual cost of installation and maintenance.

The committee on Signaling and Interlocking of the American Railway Engineering Association included in its report three years ago a table of operated unit values. This table was reasonably complete and reasonably fair. It provided for enlargements, and it has been written into quite a large number of contracts. There seems now to be a feeling that this table of operated unit values is not entirely complete, as it ought to be, and not entirely fair; also that it is not sufficiently up to date to cover the recent progress in signal construction. This committee is now asked to submit a revised table of values of units, and we have submitted at this meeting such a table.

The committee, in investigating this matter, finds that in order to comply entirely with the wishes of the members who have expressed themselves, one table of operated unit values will not cover both manual and power plants. It will not cover both construction and maintenance; that is, if we try to make the fine distinctions that some members have expressed themselves as desiring.

The committee asks discussion as to whether the division between manual and power plants is necessary; as to whether a division between construction and maintenance is necessary, and as to whether this list is too elaborate. We feel that the table which we have submitted is rather elaborate and perhaps more than required. It is perhaps true that any table on operated unit values which comes within the bounds of reason is fair between roads which have a large number of joint plants, because the thing that operates against one road at one plant will operate against the other road at another plant. Also, almost any table which will come within the bounds of reason will be fair as between two companies, when you consider a long period of years, and the committee would like to have the members consider those points in discussing this matter.

C. E. Denney (L. S. & M. S.): I would like the chairman to say what was taken as a basis for the value of one, assuming that this must be figured out on the basis of dollars and cents. I assume this must have been figured out in that way, or they could not have found that a fixed one-arm signal has a value of one and a one-arm two-position signal have a value of three for construction, and the maintenance of the one-arm fixed signal is only one-tenth of that of the operative two-position signal, although the fixed signal has a light.

Mr. Clausen: This table was not made up on the basis of dollars and cents. The committee expected to secure some information from outside sources as to the actual value in dollars and cents of the various units that are enumerated here, but we did not get that information in time. This table was made up from previous tables and from the experience of the signal engineers who form the committee.

L. R. Mann (Mo. Pac.): It does not seem right to me that a one-arm three-position signal is three and a one-arm two-position signal is the same, all through the table. It appears that a two-arm two-position signal and a one-arm three-position signal should be of about equal value.

F. P. Patenall (B. & O.): I think, if the chairman can in any way enlighten us as to the basis on which this thing has been prepared, it would be of interest.

Mr. Clausen: The fixed one-arm signal is given the value of one, and everything else is relative to that. It is immaterial what the basis is as long as you make the figures relative.

W. H. Elliott (N. Y. C. & H. R.): It seems to me the values for construction might properly be based on cost. A division on a cost basis or a material basis, would, I believe, be a fair one. Mr. Clausen, in his introductory speech, brought out strongly the fact that the committee believes that a division on a cost basis would be fairer than one on an arbitrary assumption of values for given units. I have found the plan of dividing expense between roads for joint interlocking on a basis of cost of material to be very satisfactory. It eliminates a good many questions as to the distance of functions or the manner in which the various units are connected to and controlled by levers. With a division on the cost basis it would seem that there is no necessity for a table giving units for construction purposes, because the number of units assigned to a given road would be immaterial. I believe that a division on a cost basis is a fairer proposition for maintenance expense, particularly where a plant is now or where there is to be a division with a given plant. Personally, I would favor an arbitrary unit basis, such as is proposed by the table only at those plants where a division has not been agreed upon formally or a plant is in service, and the value of the parts might be in question. In such cases a unit basis might be readily applicable, the same as a lever basis, but I believe any such data would be merely an assumption. This table, to my knowledge, is the fifth or sixth one that the various committees of representative bodies have prepared, and on checking them I find that they vary 100 to 200 per cent in the values assigned to various units.

Mr. Denney: I think we can determine both questions: whether or not we need two function tables, and what the function table should be, only if the committee will secure, from as large a number of roads as they can, figures showing how this would work out in their standard practice; in other words, how much money they think would be charged on the basis of plants installed for each one of the items shown. If then the relative values of the power and the mechanical plants develop to be about the same, one table is certainly advisable if it appears fair. I do not believe in going into too much detail in dividing the plant. For example, a number of roads have agreed recently on tables that are approximately the same, that do not show charges, as this proposed table does, for a tower indicator signal. They do show charges for a two-position signal, a three-position signal, an automatic two-position signal, and an automatic three-position signal.

Mr. Clausen: The signal engineers forming the committee had considerable information as to the cost of installing various units, and that information was used in making up the table covering construction. There was certain outside information which we expected to get before this meeting, which was to be exact, but which has not been received. The table covering maintenance is the result of experience of the signal engineers forming the committee and on the information they have received elsewhere. I, perhaps, did not make clear in my opening remarks that the committee favors a table of unit values rather than a cost of material basis. Mr. Elliott did not understand, evidently, what I did say. The committee feels that the table presented is a much fairer division, both for construction and maintenance, than a cost of material basis for either of those purposes. The reason for that is that it will cost more money to determine what the basis should be if you use the cost of material, than the maintenance of the plant would probably be for two or three months. How are you going to divide the cost of labor of a man that works half an hour on one line and half an hour on another line? How are you going to divide the cost of a common wire used for both lines? How are you going to divide the cost of the stove that heats the interlocking plant? There are a thousand and one items of that character that cannot be divided except on an arbitrary basis, and when you get through you are as far from the correct solution as if you used a table of this kind.

W. H. Arkenburgh (C. R. I. & P.): I think the joint items spoken of by Mr. Clausen could be very easily settled by leaving them out and dividing them afterward on the basis of the other material which is not joint. Furthermore, I believe the maintenance could be handled better on the cost of material basis, with, for example, a wheelage basis. I do not believe it is fair to charge a road maintenance and operation on a certain fixed ratio based on the cost of the plant or the number of units in it when they have, say, only one-tenth the number of trains the other road has.

Mr. Stevens: The great question is whether we are going to make any money. If we are going to spend $20 or $30 to get this information, or possibly $50 or $100, as I know has been spent in one case, we must cover the charge in our operating expenses of determining these very minute values, as to whether we have every pin charged in the bill against the other company. Now, about construction and maintenance, I take it the majority of joint plants are crossing plants. It does not matter whether one railway has an extensive installation and another one has a very slight installation. Each one is interested in the protection of that crossing. To a very great extent the whole plant is joint. Mr. Clausen said that this thing evens up when two roads have a lot of joint plants. That is true. We have made test cases two or three times and found that in 40 or 45 plants, taking their different bases of division of cost, there was not $2,000 difference in the whole bill that would have been paid by one railway. The same is true of another series of plants that I am interested in where a test case of the same kind was made.

J. A. Beaumont (C. G. W.): I agree with Mr. Stevens that the table of operated unit values is the best as the basis for

distribution of the cost, both for construction and maintenance. I would like to suggest to the chairman, however, that they carry the table further to show the basis for operation charges. How is that taken care of in the maintenance charge? We have a charge for construction, a charge for maintenance, and naturally we have to distribute the operating charge.

Mr. Clausen: The committee has not attempted to take care of operating charges. With regard to the question of obtaining information as to the cost of material, I know of a case where a company, in making an enlargement to a mechanical plant, was put to an expense of nearly $1,400 trying to determine what material was used on the various lines. Nine hundred dollars of that was interest, waiting for the bills to be paid. If an interlocking plant was composed of four or five, or eight or ten different kinds of material, and no more, I would be perfectly willing to go into the cost of material basis; but you have probably eight or ten thousand different kinds of material in an interlocking plant, and it is wholly impracticable to try to find out the cost of those various items which are assignable to each company.

Mr. Mann: Several years ago Mr. Balliet appointed several committees to handle this subject. Their reports were taken into the association records. The criticism at that time was that those reports were too complicated; so a harmonizing committee was asked to simplify it. It, of course, was very flattering to those committees to find that the harmonizing committee worked the other way; but, at the same time, I would hesitate to incorporate in a contract for joint facilities this very complicated table. I believe the committee ought to look very strongly to the question of cost. The cost of each of these items should be figured out, and if the costs are reasonably close we ought to have not more than 15 items instead of 38. I know of railways which have, for the sake of simplicity, incorporated each of these tables in every contract of joint facility. I believe this is too much.

J. C. Mock (M. C.): Assuming that the report will be adopted as submitted, on the basis of unit values, I believe the table should be very complete and that it should have two lines, one for manual plants and one for power plants, for the reason that we have plants called electro-mechanical. In that case we would have both the mechanical unit and the power unit. I see no reason why each contract should include every item, but this table shall stand as a complete table, and when making the contract for any particular plant such of the unit values as exist at this plant may be taken from this table.

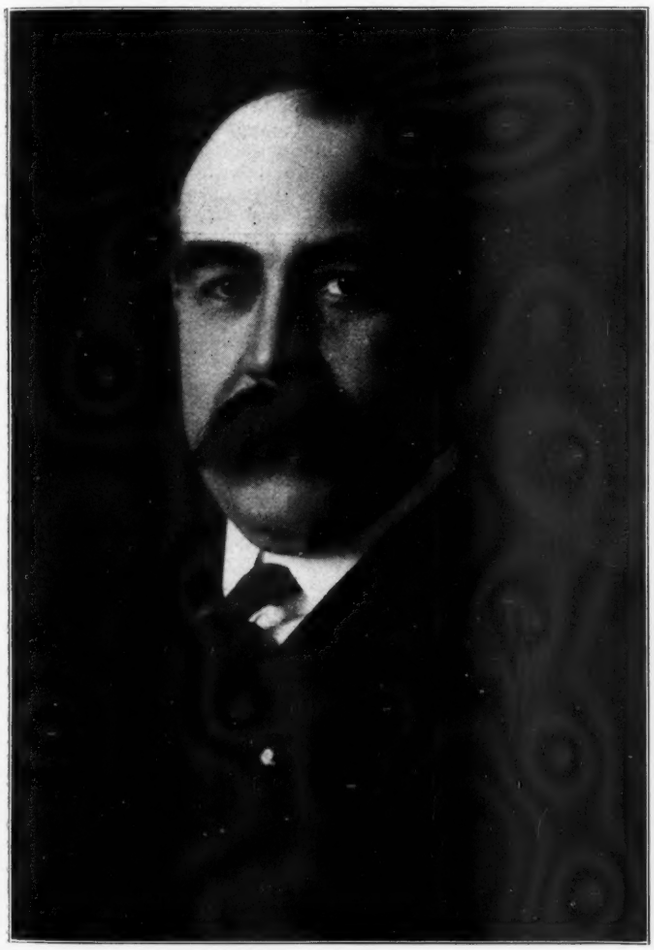
Mr. Denney: I would like to call attention to one charge and ask the committee to give it further consideration. The maintenance charge for one-arm two-position signal, regardless of where it may be, and whether it is a high signal or a low signal, is one, and the charge for the fixed one-arm signal is one-tenth of one. In other words, for a fixed distant signal with a lamp on it, 2,000 feet from a tower, the maintenance charge would be one-tenth of that for a dwarf signal close to the tower. For my information and for the information of the committee, I am going to compare this table with some function tables which we have been using. I don't think many of us are in a position to say whether these values are correct or incorrect.

Mr. Clausen: If Mr. Denney will look a little lower down he will find an item covering dwarf signals, which we call low signals. The lamp does not enter into this problem at all. That is an operating charge.

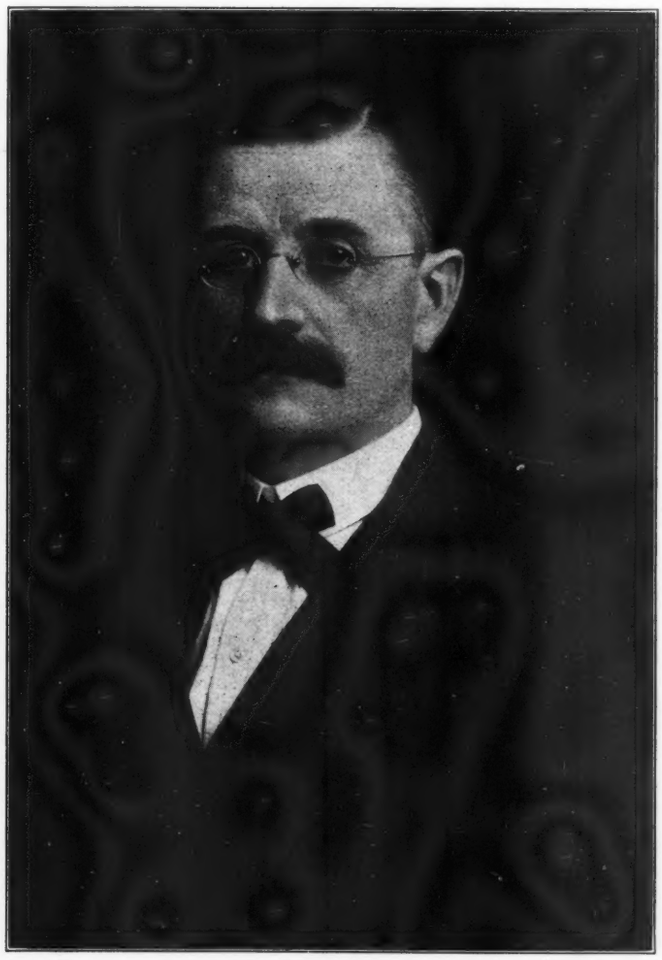
Mr. Mock: Did I understand the chairman of the committee to say that this table did not bear any relation to cost, or just apuproximate cost?

Mr. Clausen: The table is based on approximate cost. We think it entirely impracticable to draw up a table based on exact cost, as Mr. Denney requests. Of course it is wholly improbable that the cost of installing a derail at one place is the same as the cost of installing a derail at another place. Unless the divisions are exactly the same the costs would be different. Therefore, any table made up on approximate costs is as good as one drawn up on exact costs for any particular plant.

Mr. Denney: There are certain charges in the plant which are really operating charges that ought to be divided on the same basis as the apparatus which is being maintained, for



F. P. PATENALL, Vice-President.



C. C. ROSENBERG, Secretary.

example, lubrication and the care of lamps. An entirely different division is made in a great many cases, and the division of salaries of the levermen, which is an operating charge, is probably determined by some older agreement. So there must be a basis for dividing the operating charges, such as lubrication and the care of lamps, which will probably be the same as the basis for maintenance.

President Anthony: It might be well for the committee to consider that later, to determine what operating charges should or would be divided on substantially the same basis as maintenance.

Mr. Clausen: The committee has not attempted to cover operating charges by this table of operating units. No table that has been drawn up to date has attempted to do that. It is wholly out of the question to assign a value to a fixed distant signal, for example, which will fairly represent the maintenance cost, and at the same time have that value fairly represent the operating cost.

Mr. Shaver: I would ask the chairman to state, if he will, the reason for the large difference between the values assigned to construction and maintenance in the manual plant as compared with the mechanical plant.

Mr. Clausen: The reason for the large difference between the construction and maintenance of the one-arm two-position signal, in line one, for example, is that the fixed one-arm signal is taken as the basis of one for the construction cost and the one-arm two-position signal is taken as the basis of one for the maintenance cost.

Mr. Stevens: I move that one table be used to cover both construction and maintenance for manual plants and power plants.

Mr. Denney: Mr. Clausen asked us if there should be two tables. I would ask him to say why the committee has presented two tables.

Mr. Clausen: Because of the voluminous kicks we have heard at various times from certain engineers to the effect that they have received the worst of it at some particular plant. In order to compile a table which would be large enough to cover all the various points which may be met from time to time, we present this elaborate table. The question is whether that is too elaborate.

Mr. Shaver: I want to call attention to the fact that the operaing expense cannot be separated from the maintenance expense wholly. We do not want to have to keep separate accounts for small plants or large ones if we can aovid it. It is, therefore, desirable to have a basis on which the operating expense can be divided the same as the maintenance expense. I know a number of cases where the operating expense, such as oil and battery supplies, are divided on the same basis as the maintenance charge. Now, if we have to attempt to keep these separate, our accountants would never know where they stood. They are not signal engineers and they must have some basis on which they can simplify the work. In regard to an elaborate table with a distinction between a manual plant and power plant, I think it is desirable. It is a fact that the cost of construction and maintenance which might answer for a manual plant will not answer for a power plant. Furthermore, each year as we have progressed in signaling there have been more details which we have to consider, and I think, therefore, that the committee has done pretty well in covering this matter as they have.

Mr. Beaumont: I second Mr. Stevens' motion.

Mr. Denney: So far as I can see, the maintenance distribution is the same for every plant, so that we have four tables which might be condensed into three tables.

Mr. Mock: I feel that that motion ought not to carry, for the reason that this table ought to be a very complete guide, for a man who wishes to make a contract for a particular plant, to enable him to pick out the things that apply and are proper for that contract. If we combine these two we do not give the information that frequently would be wanted. I am not prepared to discuss the correctness or incorrectness of the relative values as published. I assume this committee will determine that by further investigation, and if it happens that the maintenance of the power plant is in all cases the same as the manual plant, then I think they can be combined, but where it does differ, both columns are needed, and I do not believe it is quite practical to include operation unless you assume ownership and a few things like that. So I am in favor of quite a detailed list, based upon cost of construction, as far as practicable.

Mr. Stevens' motion was withdrawn.

Mr. Clausen: The committee would like to have a vote on three motions: First, as to whether it is necessary to have two tables, one for manual plants and one for power plants; second, as to whether there should be two tables, one for construction and one for maintenance; and third, as to whether this table is too elaborate or not.

B. H. Mann (Mo. Pac.): I hope that Mr. Stevens' motion will be put as it was made, and not defeated. We must have one table to go into the contract, because we do not know the details of the plant complete, in any case which we may have in mind, and we want to have the matter in the most simple form possible.

Mr. Denney: Will the chairman of the committee say if their investigations show that two tables are advisable, or whether the two tables are presented because there seems to be a feeling that some people want two tables?

Mr. Clausen: As was explained some time ago, the table is the result of trying to cover the various complaints registered by those who felt they were getting a deal that was not exactly square at some particular place. That is why we provided two tables, one for the manual plant and one for the power plant, because there has been a very vigorous protest against trying to divide up the construction and maintenance of the power plant on the same basis as the manual plant. We would like an expression of opinion, which we have not yet received, as to whether two tables are necessary.

The President: This discussion has been pretty thorough, and it seems to me that at the request of the chairman it would be entirely proper to take the tentative votes suggested merely for the guidance of the committee. I will ask the active members who are in favor of having separate tables for manual and power plants to rise.

(Twenty-six members voted in the affirmative, and 15 members voted in the negative.)

Those who favor separate tables for construction and maintenance, believing that the values of some items should be different, will please rise.

(Fourteen members voted in the affirmative and 30 members voted in the negative.)

The third question is as to the length of the table. The point is to get the general expression of opinion as to whether the table should be quite full of details or whether it should be condensed as much as posisble, with only a few items. Those who favor the longer table will rise.

(Nine members voted in the affirmative and 27 members voted in the negative.)

Mr. Denney: The question as to whether the table should be longer as shorter would probably not come in the first 25 items relating to straight interlocking. There is always some question as to how many specials should be put in.

Mr. Mock: I suggest a vote be taken on whether or not the association desires a complete table, one that will set forth conditions which will obtain at every point.

The President: Obviously the association table should be complete to cover all plants.

Mr. Shaver: It looks to me as if this committee had given this question considerable study and had covered the ground pretty well. There is no doubt in my mind they have covered all the details necessary. The members should bear in mind, however, that we have combinations of mechanical and power interlocking, some use switch and lock movements, without bars, others facing point locks with bars, with electric locks, etc. In some places there are automatic block signals through the plant, whose use in the future will be greatly extended. This table should cover in detail everything that is going to exist in a situation of this kind.

Mr. Denney: I move that it is the sense of this meeting that the divisions 1 to 25 are necessary. It is the understanding, while they may be revised, practically the same information should be shown in the table providing the straight interlocking.

(Three members voted in the affirmative and six members voted in the negative on the forgoing proposition.)

PROGRESS OF WORK ON THE MANUAL.

Mr. Eck reported that the committee of the Board of Direction having in charge the preparation of the manual of the Railway Signal Association has had a number of meetings and has the matter in such shape now that it can reasonably promise the issuing of this manual about the 15th of June, or the 1st of July. This manual will consist of all of the specifications of the association which have been approved by letter ballot, all of the typical circuits, all of the standard drawings, and the other matters which have been approved by the association, which, in the opinion of the Board of Direction are of sufficient importance to be included in such a publication.

The manual will be issued in loose leaf form so that it may be kept continually up to date. The binder will be of heavy green canvas so that it will stand a very large amount of wear and be uniform with the other bound volumes of the association, being the same size, and two inches thick, so that it will hold something like 600 pages. At the present

time we assume there will be 425 pages in this manual. The specifications will be printed on both sides of the sheet and all of the drawings and standard designs will be printed on but one side of the sheet. This will make it very convenient for any one who wishes to take any one of the drawings for the purpose of tracing, or anything else.

The manual will be very easy to keep up to date, because new pages can be easily inserted in the binder. We expect to have a portion of the work done and some of the binders on exhibition at the annual meeting. The quality of the paper will be very much better than is ordinarily used in the proceedings, and will stand considerable wear. The cost of the binder to members of the association and manufacturing concerns closely affiliated with the association will be $4, which is practically the net cost to the association.

All of the specifications will be consolidated; that is, the material which has been adopted at the various annual meetings will be brought together and the specifications harmonized so that you will know when you get this manual that you have the very latest practice of the association in reference to every one of the specifications. The association has gone to considerable expense and the members of the manual committee and others have devoted a very large amount of time to this work and it is hoped that every one who can will give the secretary an order for one or more of these volumes. At present we have orders for 250.

The Secretary: I would like to add that there seems to be a question as to how these manuals are to be procured. Some of the signal engineers have taken this matter up with their respective railways asking them to make a purchase. Already a number of orders have been received from the purchasing departments of the railways for these volumes. Signal engineers and others who are interested in securing a copy of the manual might take this matter up with their purchasing departments.

POWER INTERLOCKING.

The committee was instructed to (a) prepare specifications for apparatus and materials used in power interlocking construction; (b) continue investigation of a device or arrangement that will provide protection equivalent to that afforded by the bolt-lock in mechanical interlocking; (c) continue the preparation of typical circuit plans for electric interlocking; (d) prepare plans of wire ducts and terminal boxes; (e) prepare specifications for protection of drawbridges by power interlocking; (f) investigate the use of "battery" indication on semi-automatic, power-operated signals; and (g) to report on a classification of voltage ranges for signal wark, to be prepared by the chairman of this committee and the committees on Automatic Block and on Electric Railway and Alternating Current Signaling. (This committee was asked to have some of its continued work ready for discussion at the March meeting.)

Sub-committee E submitted a progress report offering a number of changes in the specifications for electro-pneumatic interlocking, as printed in Vol. 14, No. 4, of the journal. These changes were in connection with clause 3, drawings; clause 340, detector bars, general; and clause 20, general electric requirements.

The committee consists of B. H. Mann (M. P.), chairman; R. C. Johnson (N. Y. C. & H. R.), vice-chairman; Burt Anderson (A. T. & S. F.), W. H. Arkenburgh (C. R. I. & P.), E. J. Clark (P. R. R.), M. H. Collins (H. & M.), J. R. Decker (M. C.), A. B. Du Bray (Frisco), J. D. Elder (K. C. T.), G. B. Gray (P. R. R.), W. H. Harland (N. Y. O. & W.), H. H. Harman (B. & L. E.), W. N. Manuel (G. R. & I.), G. A. Motry (B. & O.), H. H. Orr (C. & E. I.), W. M. Post (P. R. R.), I. S. Raymer (P. & L. E.), D. W. Rossell (N. Y. C. & H. R.), O. R. Unger (M. P.), F. B. Wiegand (L. S. & M. S.), and G. A. Ziehlke (U. P.).

Discussion on Power Interlocking.

Mr. Johnson: Sub-Committee E has considered a number of changes in the recommended specifications which has been suggested by the Board of Direction or by the chairman of the committee. Three changes are submitted at the present time.

The first relates to clause three, drawings. In this clause the three drawings or exhibits, B, C and D, were omitted from the specifications. After consideration the committee decided to insert these three exhibits. They are the same as in the mechanical and electro-pneumatic specifications.

The second amendment is in clause 340, relating to detector bars, general. The specifications as they were submitted at the Colorado Springs meeting called for detector bars 55 ft. long. It was decided at that meeting that the length of the bar be omitted and the space for the insertion of the length be left blank. The instructions to the committee were to consider this matter further and it is now desired to substitute the following paragraph (b): (b) Detector bar shall be not less than eighteen (18) inches longer than the inside wheel base of the maximum equipment run over the road and shall be arranged to give continuous protection for all switches, derails, movable wing frogs and moveable point frogs.

The third amendment relates to clause 20, general electric requirements. There was considerable objection to the 3000 volt tests on electric apparatus in connection with electro-pneumatic interlocking and we were instructed to consider this. We have had the matter up with the manufacturers of electro-pneumatic interlocking and decided to reduce the requirements to 2000 volts.

Mr. Shaver: With regard to clause 340, it does not seem to be practicable to state the requirements in that way. We ought to give it in the number of feet. If we are going to contract for a job of that kind, we certainly are not going to let the contractor look all over the road to find the car with the greatest space between the wheels, and I think it should be exactly stated what it should be. It is not going to be a hard ship on any railway to take the maximum requirements.

Then, with regard to clause 20—the Sub-committee on Relay Specifications, I think, has discussed this on the basis of using 5000 volts. It seems to me that whatever is used for one test should be used for the other. If at all possible we should have one established voltage for testing the coils and other electric apparatus.

The President: Would not the proper course be to leave the specification blank as to length, and provide a foot note suggesting the association's opinion as to how the length may be determined by each railway?

Mr. Stevens: That will save changing the standard of the association every year or so, as the equipment increases in length.

Mr. Arkenburgh: Sub-Committe A has also had that in consideration and reached the same conclusion as this sub-committee, except that they state the minimum length must not be less than 55 feet.

Mr. Johnson: There are a number of roads whose equipment is such that 55 ft. would be excessive.

W. H. Elliott: I am rather not in favor of putting any note of the kind suggested in the association specification, because I believe if a minimum length of bar should be decided on it might put some of the roads in a bad position, and it would discredit the road in case of an accident, if by any possibility the detector bar should be the cause of the accident. We have been using a 50-ft. detector bar as a standard for a long time. Switches facing each other in a single track have been spaced 50 ft. apart, and to use a 55-ft. detector bar would practically mean the rebuilding of 75 per cent of the switch layouts of the railway. For that reason, we would be very loath to adopt or to use as a standard a 55-ft. detector bar. It would seem wiser to leave it to the individual roads to determine what length of bar each will use and leave out any such foot note.

Mr. Denney: I move that it is the sense of this meeting that the length of detector bars in all specifications referring to detector bars shall be left blank, with no qualifying note.

Mr. Shaver: It seems to me this will add to the complications. I think it is quite necessary to state the length of the detector bar to be used; either minimum or maximum, or some dimensions as a guide.

Furthermore, there is the question of buying detector bar material, getting it the proper length, so that there will be a minimum amount of waste.

It seems to me that this association with the information it has can very well state in a foot note what it believes to be a good length of detector bar. There is no reason why, if one road in this country requires 100-ft. detector bars, all the roads in the country should use 100-ft. detector bars. You can, however, say that good practice is a bar of a certain length. In some of our specifications we have recommended a coil of a certain resistance. We have left the space blank, in the body of the specification, but stated in a foot note that a 500-ohm coil is considered good practice. I think we can do the same thing in regard to this specification.

C. J. Kelloway: The Committee on Mechanical Interlocking has given this question considerable thought, and we do not recommend any specific length for detector bars, but recommend that detector bars shall be arranged to give —— feet of continuous protection for all switches, derails, movable wing frogs and movable point frogs. We do not men-

tion any specific length. Some roads will require bars of longer or shorter lengths. If all bars are made up in 19-ft. sections it will be an easy matter to install bars varying from 38 to 57 feet in length and if bars of intermediate lengths are required one section may be cut to the required length.

The President: It is moved that the length shall be left blank, and no note inserted to show how the length shall be arrived at or what length is recommended.

(Thirty-eight members voted in the affirmative and 5 members voted in the negative.)

Mr. Johnson: Mr. Shaver in commenting on the changes proposed said he thought that 5,000 volts should be required for testing all magnets. The reason for making the change from 3,000 to 2,000 was that one of the manufacturers of electro-pneumatic interlocking plants claimed that it would cause them to redesign a considerable part of their apparatus, and in view of the fact that electro-pneumatic interlocking has not suffered heretofore on account of requiring a test voltage lower than 3,000 volts, the committee thought it was entirely proper to call for only 2,000 volts.

Mr. Shaver: If we can arrive at one standard voltage for tests of this kind, it will simplify the question a great deal. If, however, it seems necessary to have a 3,000 or 5,000-volt test on a relay and only 2,000 on an electro-magnet or electro-pneumatic interlocking plant, I presume we will have to let it go at that. It does seem as though we should be able to work that thing out on a uniform basis. I did not mean to criticise the 2,000 volts, but I desired to see if we could not arrive at some standard voltage.

Mr. Arkenburgh: Will the committee also include tests for generators and motors?

Mr. Shaver: I should think that would be practicable.

AUTOMATIC BLOCK.

The committee was instructed to (a) prepare revised specifications for direct-current relays and direct-current indicators; (b) continue preparation of specifications for apparatus and materials used in automatic signal constructions; (c) prepare typical automatic signal circuits for single and double track; and (d) chairman to help prepare a classification of voltage ranges for signal work, to be reported by the committee on Power Interlocking. (This committee was asked to have the relay and indicator specifications ready for discussion at the March meeting.)

The committee submitted, as a preliminary report, specifications for steel crossarm pins, covering the subjects of purpose, material, strain test, galvanizing, packing, marking, sampling, inspection and acceptance. The specifications are accompanied by R. S. A. drawings 1165, 1166 and 1167.

Sub-committee No. 1 offered specifications for direct current relays, lifting armature neutral type. The specifications cover the subjects of definition, purpose, general design, material and workmanship, finish, armature, supports, air gap, nut locks, iron in magnetic circuit, magnet coils, contact fingers, contacts, flexible connections, binding posts, insulation, magnetic iron test, service, calibration test, sealing and calibration record, inspection, packing, and acceptance.

Sub-committee No. 4 presented specifications for copper and tin plate channel pins. These referred to the subjects of purpose, material, malleability, plating, copper plating, tin plating, and the method and solution for testing the tin plating, gauging, sampling, packages, markings, inspection, and acceptance.

The committee consists of A. G. Shaver (C. R. I. & P.), chairman; J. M. Fitzgerald (N. Y. C. & H. R.), vice-chairman; E. L. Adams (L. S. & M. S.), E. E. Bradley (Western Maryland), G. H. Dryden (B. & O.), A. R. Fugina (L. & N.), J. E. Gillmor (P. R. R.), R. E. Greene (M. C.), W. R. Hastings (C. R. I. & P.), W. H. Higgins (C. R. R. of N. J.), B. F. Hines (N. O. & N. E.), E. W. Kolb (B. R. & P.), E. W. Newcomb (O. S. L.), C. W. Parker (C. P.), R. M. Phinney (C. & N. W.), H. J. Rhinehart (D. L. & W.), A. H. Rice (D. & H.), and G. W Trout (P. M.).

Discussion on Automatic Block.

Mr. Shaver: The specification for steel crossarm pins is the specification of the Western Union Telegraph Co., with this exception: It was redrawn to put it on the same basis as our usual specifications in respect to dividing it into paragraphs and supplying paragraph headings; also with the exception of the test for galvanizing. I did not have the Western Union company's requirements for galvanizing, so I substituted the galvanizing test we have for wire in the previously adopted specification of the association. The drawings are exact duplicates of the Western Union company's drawings, with the exception of the spelling of one or two words.

C. H. Morrison (N. Y. N. H. & H.): Did the committee consider locust wooden crossarm pins?

Mr. Shaver: They did not.

Mr. Morrison: Has the iron pin been adopted as standard by the association?

Mr. Shaver: It has not.

T. S. Stevens (A. T. & S. F.): I would like to know if the committee expects to get out specifications for wooden pins?

Mr. Shaver: The matter had not come to us that a specification for wooden pins was necessary. I do not see, however, why the committee should not get out a specification if the association deems it necessary.

Mr. Stevens: It is necessary; particularly so down on the gulf coast, where we cannot use iron pins at all, and have to use wooden pins. I think the same will be true of any seacoast; that the iron pin is not a good pin to use.

Mr. Shaver: The committee will be glad to take that question up. We thought we would describe the iron pin first, because that is now the Western Union standard.

The President: The wooden pin will require a modification of the crossarm design on account of the pin holes.

W. J. Eck (Southern): There does not seem to be any specification or description of the threads on the spindle. Should not the title of detail 1 in the lower left-hand corner of print 1166 be detail 4? On print 1165 it is marked detail 4.

A. G. SHAVER.

Chairman Committee on Automatic Block.

President Anthony: Does not it say "Fit thread on detail 1?"

Mr. Shaver: Yes, that is right. The cap is detail 4.

Mr. Eck: It is marked detail 4 on one drawing and nothing on the other.

Mr. Shaver: That will have to be taken care of.

H. S. Balliet (N. Y. C. & H. R.): The committee shows a galvanizing specification. This subject has gone to some other committee. Should we not say: "Galvanizing.—See Railway Signal Association Specifications," and eliminate all this printed matter? We have complete specifications.

Mr. Shaver: That is true, yet there are many who want to use this specification and will not want to use the other specification. It would seem to me a good plan to strike a sort of happy medium, and where it is not necessary, not to give the specification in duplicate in its entirety. As this specification was taken, I think, from one of Mr. Elliott's specifications, I assume that it would be agreeable to him to have it used, and there is no need for harmonizing it.

W. H. Elliott (N. Y. C. & H. R.): I am not at all sure that the test for galvanizing given here, which is for iron wire, is sufficiently strong for the testing of galvanizing on a steel pin, on which, as I understand it, the galvanizing is put on very much thicker. It would seem to me advisable for the committee to get the Western Union specification for galvanizing and possibly it would be better to adopt that, or change this wire specification.

Mr. Stevens: We might take the American Railway Engi-

neering Association test for galvanizing bridge bolts and things of that kind. They have a very good specification.

Mr. Shaver: It seems to me the various committees concerned in the galvanizing test should get together, if possible, and harmonize this specification. If we need a different galvanizing test for crossarm pins from what is required for wire, then we ought to have it; but if we do not need it I think we ought to make one test answer in so far as we can.

L. R. Mann (Mo. Pac.): The pin which we are using is the standard of the Western Union and the A. T. & T., who are very large consumers of this pin. If we do not have a specification which calls for a regular article in the market, it will probable mean a rise in price for something which is probably no better than we could get out of stock. I would like the committee to look into the specifications of the Western Union Telegraph Co. for galvanizing, and see whether these specifications are not sufficiently complete to be adopted by this association.

Mr. Shaver: The committee will be glad to accept all the suggestions and look into the specifications further.

E. L. Adams (L. S. & M. S.): The Sub-Committee on Relays has gone over the discussion that was had at the annual meeting at Colorado Springs and they have embodied in this preliminary report as many of the suggestions that were brought out at that meeting as they could approve; that is, we have gone ahead with the idea of being able to approve everything that we put into the specification. Although there may be some things in this one which we were not able to approve, we hope to be able to justify everything at the next annual meeting.

The articles have been revised somewhat. and some of them combined and brought together, so that everything under one subject will be under one paragraph. That was done with the idea of making the specifications shorter, if possible.

There is nothing said in this preliminary report about the most important part of the specification, the test for the iron and operation of a relay service calibration. The committee is doing considerable work along these lines and we have no doubt we will be in shape to submit it at the annual meeting, in all its details, at the meeting in June.

We might bring up for consideration a joint in paragraph 5 on Finish. The committee has had some discussion on that paragraph and it might be well for the members to express some opinion on it. That refers to copper plating the armature and particularly the magnetic core in the concealed portion of the relay.

We have had considerable experience this winter with relay sweating and rusting. In every place where we had a piece of iron that was galvanized or protected by some compound of paint the moisture has gotten under that protection and rusted the iron, so that it seemed to the committee the only thing to do was to properly copper plate the iron in that portion of the relay. That point seemed to be the principal thing for the committee to discuss at this meeting.

Mr. Stevens: I think it is usually quite proper to protect in some way the enclosed portions of the relay from rust, but I doubt the propriety of specifying any special method because, as it seems to me has been brought out previously in the discussions at our meetings, we do not want to stop development by specifying one special way of doing things.

Mr. Denney: I think this protection of the relay core is something that should be definitely specified for two reasons. The iron that is used in the cores must be very carefully handled and certain methods of applying the protection would injure if not ruin the iron. Other methods of applying the protection, while not affecting the iron, would not have the same lasting qualities and I believe that the committee should go into the question very thoroughly and find out which is the best way of doing it and then specify it.

Mr. Adams: The committee has considered this point and found there were four methods which can be used in protecting the iron; galvanizing, painting, copper plating and coating with varnish or shellac.

Mr. Stevens: How about sherardizing?

Mr. Adams: We think zinc plating or galvanizing would cover the two. It seems to me that the copper plating would be as satisfactory. We know that anything properly copper plated will not rust. We know that anything that is sherardized or galvanized or protected in any way with a zinc treatment will rust, and we found that all of the paint processes have been unsatisfactory on account of rusting, so that we decided that copper plating was the best thing to specify.

Mr. Shaver: It is a difficult matter to copper plate and get a test of that copper plating so as to know we are getting a uniform coating. I think the committee will appreciate any information that can be given them on the question of a satisfactory test for copper plating.

Mr. Denney: Do we understand the investigation of the committee along these lines has been closed, or is this subject to be given further consideration?

Mr. Adams: The committee will give the subject further consideration and are making tests now as to whether copper plating will be the best. It is the best we have found so far. There is one process of lacquering, but it seems, when you get into the question of lacquering it is difficult to specify the proper grade of lacquer and it is difficult to determine if the lacquer that is used is the proper grade.

Mr. Stevens: I think there is no question that the committee has acted properly in specifying copper plating. The only question I raised was whether there was not some other process, or whether some other process might not be discovered at a subsequent time, which might be used with less expense. I have always been averse to specifying actual materials or methods.

Mr. Elliott: In reference to the matter of copper plating, it has been my understanding that copper plating, unless burnished is a very slight protection, and rather than stating the requirement that copper plating shall be buffed, it should be burnished, and with the burnishing process you will make it hard and to a larger extent resistent to moisture. We find that moisture will penetrate a thin coating of copper—the thicker the copper the less the penetration. Also, the harder the copper the less the penetration, so that if this coating is made hard, a thinner coating will give a greater protection than one that is thicker and merely buffed for the plating.

Mr. Adams: It is the idea that the iron shall be buffed and not the plating; the buffing is used to get a smooth surface for the plating.

L. Frederic Howard: (U. S. & S.) Our representatives have met the members of the committee and volunteered to co-operate with them in any research work. It is a difficult matter to get a protective coating back of the cores. One of the difficulties is, if you get the proper air gap in the relay, the thickness of the material increases the length. I think there are at least two methods of plating; sherardizing and copper plating. There are difficulties connected with covering these parts with any lacquer, in getting such a coating as will not be affected by moisture or heat, and also securing a coating that will not scale off.

F. L. Dodgson: (G. R. S.) I know the committee is making some investigations and I am making some on my own account, and after these investigations are completed we can speak more authoritatively.

Mr. Eck: The definition, I believe, should be omitted from the specification and referred to the Committee on Definitions, particularly as the definition given here also fits almost exactly an elevator controller. The use of the word "air-gap" in paragraph seven seems to be a little confused. I believe the note under seven should be omitted and the section elaborated in some way so that there will be no confusion as to what is meant in reference to the air gap.

Mr. Balliet: I suggest that it is perfectly proper to refer the definition of a relay and the note in paragraph seven to the Definition Committee for disposition. I believe that it would also be of considerable interest and assistance to the Definition Committee if this committee were to formulate their idea of definitions for Armature Journals and Armature Bearings.

Mr. Adams: The definition of a relay has been taken up with the Definition Committee and they have approved this form with the addition of the words "one or more" after the word "controlling," making it read "A relay is an electromagnetic device with contacts for controlling one or more electro circuits."

Mr. Balliet: The purpose is not to show in any specification or in any of our literature a definition that will be in the Definition Committee's report.

Mr. Adams: I believe that all of the committees on specifications should get together and get a uniform paragraph for the acceptance of material. It seems now there are a number of different paragraphs and I believe they should all read alike.

Mr. Shaver: This clause has been passed by the association in other specifications, and it is intended to mean that the entire shipment can be rejected in case it does not meet the specification.

Mr. Denney: Paragraph 7 specifies that stop pins shall be not larger than one-eighth inch in diameter and the projecting end shall be rounded to a radius not less than half the diameter of the pin. There are some coils made without any stop pins in the cores, and others made with them. The committee having decided there should be stop pins, I would like to find out why they specify they shall be round with a radius which shall not be more than one-sixteenth

inch. It looks like a rather small radius and I do not see just what they expect to accomplish.

Mr. Adams: Since putting that in the specification the committee has considered cutting out the requirements of stop pins in the armature entirely and we prefer having no discussion on this paragraph at this time.

Mr. Shaver: Under paragraph 3 the ventilation of the relays is an important thing to be brought up. In my own experience it has been one of the most troublesome things we had to deal with.

The President: The committee will be very glad to have suggestions as to the means of ventilating the relay and improving the service.

Mr. Shaver: We have ventilated the relays and our general reports are in favor of it, but sometimes we get reports that ventilated relays are not so good as the others. In the opinion of some engineers, it is necessary to close them up as tight as possible to prevent dust entering, but generally the reports are in favor of ventilating.

George E. Beck (L. S. & M. S.): May I ask Mr. Howard if the so-called ventilated relays have openings at the top and bottom or merely at the bottom?

Mr. Howard: I suppose the standard relays have openings at the top and bottom.

Mr. Shaver: I would like to ask Mr. Howard if he has received sufficient information to know what ought to be done with them, or if the whole road is still equipped with them?

Mr. Howard: We have not enough exact data to answer that question, but if I had to pass an opinion now I would say that ventilated relays were desirable.

Mr. Balliet: I assume Mr. Howard means in other places than in tunnels, or protected railways; in other words, out in the open country.

Mr. Howard: Yes.

Mr. Shaver: I have had considerable experience with relays ventilated and not ventilated, and I have not been able to notice much difference between them. I believe Mr. Howard is right, that a ventilated relay will give better service than one that is not ventilated; but I think we must arrange for circulation of air through the relays. In other words, there must be not only ventilation in the bottom, but in the top; and I am going to bring that before the committee and have it discussed with a view to having it included in the specification, unless we find that that theory is not correct.

Mr. Denney: We have had a number of cases, particularly this winter, on account of the weather conditions, where relays ventilated and relays that were supposed to be air tight, have sweat. In a good many cases there was much water in them that, so far as we could determine, did not come from the outside. I believe the term "ventilated relays," as Mr. Shaver says, is a misnomer. They are not really ventilated. They have a little hole in the bottom, and this committee should at least look into the advantages and disadvantages of allowing the air to circulate, practically establishing a draft through the relays. Recently we have had a man going over the entire road to study this subject and bring in data as to the making up of the relay, whether or not it is ventilated, and the peculiar conditions, either as to being in a wooden or an iron relay case, on one side of the right of way or on another, protected during certain parts of the day, or protected or not protected from the sun. We thought that our only chance was to eliminate conditions by finding out the conditions at each place where a relay had given trouble.

Mr. L. R. Mann: I have never seen trouble where the relay case was put on the relay support with U-bolts. I think that that overcomes it.

Mr. Balliet: I have had cases where the relay has been in trouble on account of sweating, fastened with the U-bolt. I believe from observation that a relay contained in a wooden box, that is, a wooden container placed on the side of the right of way, removed from the sun's rays, is the only cure. You cannot afford to establish circulation or breathing through the relay, for the reason that there is a great deal of moisture, under certain conditions, contained in the air, which is dangerous if it gets in the moving parts. Particularly if the temperature changes suddenly.

John J. Craig (P. R. R.): With a ventilated relay you cannot expect anything but moisture on certain parts. I don't think we ought to allow free circulation at the top and bottom of the relay, because that will induce breathing action, and I am afraid the moisture will be deposited on the box and soak through. It seems if there is an accumulation of moisture in the relay it should be allowed to run right out.

J. A. Johnson: (M. K. & T.) I would not recommend the relay ventilated at the top and bottom both. I think there must be some mistake about the relays that are sealed up tight. I do not think they are air tight.

A. R. Fugina: (L. & N.) I have found much less condensation in ventilated relays than in the relays not ventilated. We have rebuilt the majority of our relays, ventilating them with a small hole in the bottom of the case, and have found that that has, to a great measure, remedied our trouble. We still have more or less condensation, but it is only a fraction of what it was originally. We have this trouble in all kinds of cases, wooden cases and iron cases. I am satisfied that we must have a ventilated relay, but I do not believe it should be ventilated at the top and bottom.

E. W. Newcomb: (O. S. L.) We have had cases where relays sweated in one location one winter, and the same relay without any changes made in it whatever, would not sweat the next winter in the same location. I think it is the local atmospheric conditions that cause the sweating in certain locations, depending on weather conditions.

Mr. L. R. Mann: I know of a relay that was sweating in a particular case and it was removed to another case and it did not sweat. They just ventilated the case and there was no more trouble.

G. H. Dryden: (B. & O.) We have no trouble from sweating on our line. Our relays are all located in wooden boxes.

Mr. Stevens: I can also say we have had no trouble reported from this cause, and all our relays are installed in iron relay boxes. I am not sure that we are not having sweating, but I know we are not having failures at all.

G. B. Gray: (Penna.) So far as I know, the only ventilation our relays have is a small hole in the case, and we are not experiencing any trouble that I know of from condensation. Most of our relays are housed in the wooden case; a good many, however, in the iron relay case.

Mr. Adams: It seems to me the members are satisfied that we should have a ventilated relay. Now I think it is up to the committee to find out how to ventilate. I think we will be able to work out something to put in the specifications.

Mr. Balliet: In paragraph seven, referring to stop pins I would suggest "fastened," instead of "riveted."

Mr. Stevens: I think paragraph nine in its present condition is more or less dangerous, because we cannot tell what the iron might do that might be obtainable for this purpose, under certain conditions of the market. I think if nothing better than that can be arrived at, it would better be left out.

Mr. Denney: I understand from what the chairman of the committee has said that they will provide tests which will determine the quality of the iron. In other words, if the iron is not right it will not meet the provisions of the specifications.

Mr. Newcomb: I would suggest that all magnet coils be flexible instead of annealed, and that terminal connections be provided to connect on the binding post.

Mr. Eck: The first word of the second sentence of paragraph 13 on Binding Posts should be omitted and the words "threaded portion of the binding post" substituted, as it is the intention of the committee, no doubt, that only the threaded portion of the post shall be made of No. 14 gage.

Mr. Shaver: I suggest that the various committees concerned with electric apparatus, which requires a test of high tension current, should get together, and, if possible, fix upon some voltage or certain voltages for tests of apparatus that are common to various specifications.

In regard to this paragraph on Insulation I think it is better to leave the last paragraph like this: "Any material that is affected by moisture will not be accepted."

Mr. Shaver: A number of gentlemen do not agree with Mr. Stevens. Some of the manufacturers have objected to cutting out the views on varnished paper or varnished cambric. They say it is not affected by moisture, but there is a difference of opinion there.

Mr. Adams: The opinion on varnished cambric and varnished paper was not put in there because it is affected by moisture, but on account of physical conditions. That is, if you try to use varnished paper for insulation and shove a binding post through it, it makes a dangerous condition.

Mr. L. R. Mann: I would like to ask if the committee thinks that the ⅜-in. air gap is sufficient for the binding post of the conducting line of the circuits for lightning protection? Wouldn't it be best to make that more?

Mr. Adams: Three-eighths inch has been the standard spacing and the committee has not spent much thought on that. I do not think any air gap can protect against lightning.

Mr. Denney: I think the last sentence in paragraph 18—"The purchaser may test all the relays or any portion thereof as he elects, at destination" ought to be removed—to read, "First, or as many relays."

Mr. Adams: I believe all the specifications for material should have practically the same wording in regard to inspection.

The specifications for copper or tin-plated channel pins were then taken up.

Mr. Fugina: The only specification we have had is the one for tin-plated pins. The instructions were to embody in this specification enough matter to make it apply to copper-plated pins, to correct the design of the present channel pin, and to design a new channel pin guage.

I want to make one correction in the heading. We should specify for copper-plated or tin-plated pins. It might now be misunderstood to mean copper pins. The only point we have had difficulty in arriving at is the copper plating that is to be applied to the pin. We were instructed to embody in this specification a chemical test for the copper plating. We have spent a great deal of time on that and had a good deal of correspondence with the manufacturers, but have been unable to arrive at a satisfactory specification for copper pins. We believe a proper way to take care of it is to specify the amount of copper that is to be used in the plating The manufacturers' idea is that it is an unnecessary refinement to attempt to test chemically the plating on copper pins, and we would like to have some discussion on that point.

Mr. Denny: I suggest that paragraph 4 on Plating be made to read, "The pin shall be plated with ——." That would make it part of the specification rather than instructions.

The Secretary: Wouldn't you change the words "are to be" to "shall be"?

Mr. Fugina: I understand certain manufacturers contemplate putting pins on the market that will be sent out in oil. They have no plating at all. They propose to put them up in boxes and ship them out in oil. The question arises whether that would be satisfactory.

Mr. Denney: I think they should be plated with something. Shipping in oil is theoretically all right, so far as receiving the pins in good condition is concerned, but they cannot be kept dry until the time they are driven, and consequently they will rust.

Mr. Fugina: The idea was to send these pins out in boxes of two hundred or five hundred, having them thoroughly oiled so they could be handed out to the maintainer accordingly, and he was to carry the little box with him.

Mr. Denney: I move it is the sense of this meeting that all pins should be plated.

Motion seconded and carried.

Mr. Stevens: There is absolutely no danger in driving oil pins; in fact they make better electrical contact than if they were not driven in oil.

Mr. Shaver: There is no use in plating the pin if it can be dipped in oil and kept sealed in oil until ready for use.

Mr. Denney: You can ship pins in oil and put a lot of oil around them, but before the men use up the pins they have a lot of rusty ones, and there is nobody that can control the handling of material to the extent that will insure their not being rusty. The plating is not for contact after the pin has been driven, but to protect them from rust before using.

Mr. Fugina: One of the most important points in the paragraph on Copper Plating has not been touched on at all. We specify that the pin plating shall be done by the electric process, in a manner similar to galvanizing. There is considerable difference of opinion as to whether the hot process or the electric process is better. Manufacturers are using both.

Mr. Stevens: I understand that both of these processes are simply to protect the pin between the time of its manufacture and the time when it is driven. After it is driven the entire process is of no use.

Mr. Shaver: At the time these specifications were presented to the association the question of tinning came up, and some pins were purchased and tinned according to the electric process. They did not meet the specifications, and the manufacturers at that time claimed they could not plate pins electrically, and have them meet the specifications. It was found desirable to use hot process pins.

Mr. Patenall: In view of the fact that we expect to plate all pins, it seems to me that the note regarding oiling pins before shipping is superfluous. If the plating is applied to prevent rust, there is certainly no need of pins being dipped in oil previous to shipment, and I would make a motion that that be eliminated.

The motion was seconded and carried.

Mr. Fugina: We would like to have the opinion of the association as to whether the copper plating specified in paragraph 5 is satisfactory or whether we should continue to try to arrive at a specification to test chemically for the copper plating. The manufacturers don't want a specification of that kind and we have left it out of the specification for that reason. I don't believe we need it.

Mr. Shaver: It is evident that the paragraph as it stands, is not satisfactory, because nothing is stated as to the method of testing the copper plating. It may be thin on one side of the pin and thick on the other. I also tried to find a specification that would cover that particular feature. It does not seem possible to get anything that is practicable for testing such a thin coat of copper.

Mr. Elliott: It seems to me that this wording of the specification is sufficient, and it is not necessary to give a more complete specification and test. The pins will sometimes rust, and the slight number saved by more careful methods will not pay for the expense of going to more complete tests.

Mr. Fugina: We have found several faults in the old channel pin drawing. One was that the taper with the axis was incorrect and in changing that, it was suggested that we embody the other changes that we thought advisable. We have presented the drawing for a new proposed design. The pin is longer, and we have tapered the point in order to make it easier to start the driving of the pin. That is one of the difficulties with the present pin. We have adopted a standard channel pin. It is a question whether we want to develop a new plan for it.

J. E. Saunders (A. T. & S. F.): We also found a defect in the old pin and we redrew it. I imagine we have practically what is shown here. We have no trouble whatever to get manufacturers to bid on the new drawing.

The President: Mr. Fugina desires to get an expression of opinion as to whether the design should be changed.

Mr. Shaver: I want to say something in support of this new design. In the use of the old design of pin on the Rock Island we had a large number of broken bond wires. We believe that one cause of the breakage of the wires close to the rail has been the use of this old design of pin. We believe that with the new design of pin we can start the wire and keep it with its axis parallel with the wire, or nearly so, so that it will not nick the wire.

The President: Are the manufacturers satisfied with this new design, Mr. Fugina?

Mr. Fugina: As far as I know.

Mr. Stevens: I would like to ask what is the object in making the thick end smaller than that of the old pin?

Mr. Shaver: The present design of pin was taken from one used by some other railways and one which the manufacturers were making. It was assumed that the taper, when figured out into the thousandths, was all right. I think it was not. It was off about one-thousandth. The fact that decimals were used in one place and fractions in another caused some confusion, and it was only discovered when an inspector checked his pins very close. Then the manufacturer kicked and showed where the trouble was.

Mr. Elliott: I move you that the present design be changed to the new one submitted by the committee.

Mr. Mock: I second the motion.

Mr. Patenall: Before that motion is acted on I think, if there are any manufacturers of channel pins here, we ought to be told whether the change as proposed is going to have any result on the pin or what changes may be necessary on the road. It might lead to something more difficult than we anticipate.

J. M. Walron (I. R. T.): I can hardly see why a design of that sort should be changed without first thoroughly satisfying ourselves that it is going to be an improvement over what we now have. If the present pin is giving good satisfaction and the manufacturers of that pin have large quantities on hand in their shops, it is hardly right that we should at this time change the design and discard the old ones.

Mr. Fugina: The design of the present pin is not correct. There are small errors that were not discovered until after its adoption. We have to make certain changes in the design, and while the drawing itself will not have to be changed, we will have to change dimensions. In that connection, we thought it desirable to go into the thing very thoroughly and change the design of the pin as a whole. We have not had time to try it out to see whether we were right or not.

Mr. Mock: In seconding that motion, it was understood by me that this was merely an expression of opinion to give the manufacturers and the railways a chance to try that out. This pin has not been tried. The other has been tried and some objections have been found. I do not think there has been a complete expression of opinion as to whether the old pin is satisfactory generally or not. This does not mean that it establishes a standard, and does not mean that the manufacturers will lose the product they now have, because I do not think the other pin is so bad that we would not accept it, or the stock that is now made. I think the association ought to be willing to do that. I do not think we ought to say we will not accept the other pin. I seconded the motion because I believe this is an improvement.

Upon vote the motion was unanimously carried.

ELECTRIC RAILWAY AND ALTERNATING CURRENT SIGNALING.

The committee was instructed to (a) continue investigation of the various systems in operation; (b) prepare requisites of apparatus and material for an a. c. automatic block signal system; (c) prepare specifications for those items referred to in the portion of the report made up by sub-committee B, 1911, which, in the opinion of the committee, cannot be covered by reference to specifications prepared by other committees; and (d) chairman to help prepare a classification of voltage ranges for signal work, to be reported by the committee on Power Interlocking.

H. S. BALLIET.

Chairman Committee on Electric Railway and Alternating Current Signaling.

The committee offered an outline of requisites of apparatus, and material for an alternating current automatic block signal system, applicable except where alternating current track circuits are in use on alternating current or direct current propulsion lines. The requisites treat of general design, dimensions and details of electric motor, solenoid, electro-pneumatic, and light type signals, alternating current relays, alternating current supply and distribution—main and secondary, circuit controllers, bonding materials, electrical conductors, wire, conduits, insulations, instrument shelters, line fixtures, switch indicators, electric locks for hand operated track switches, junction terminals, lightning arresters, number boards and numbers, locks, signal lanterns and lamp boxes, concrete and paint.

The committee consists of H. S. Balliet (G. C. T.), chairman; C. H. Morrison (N. Y. N. H. & H.), vice-chairman; W. P. Allen (P. R. R.), W. F. Follett (N. Y. N. H. & H.), E. C. Grant (U. P.), W. F. Hudson (N. Y. C. & H. R.), John Leisenring (Illinois Traction), H. A. Logue (C. V.), W. W. Morrison (N. Y. C. & H. R.), C. R. Peddle (I. R. T.), B. H. Richards (C. R. I. & P.), John Roberts (N. Y. W. & B.), J. E. Saunders (A. T. & S. F.), E. B. Smith (N. Y. C. & H. R.), W. N. Spangler (P. R. R.), F. S. Starratt (S. P.), F. E. Wass (N. Y. C. & H. R.), and J. R. Wills (O. S. L.).

Discussion on Electric Railway and Alternating Current Signaling.

Mr. Balliet: Sub-Committee A is handling all of the alternating current signaling on railways using a. c. propulsion. The next sub-committee is B, which handles the alternating current on roads using d. c. propulsion. We now have Sub-Committee C's report, as we propose to submit it to the annual meeting, to cover so-called steam lines. Acting on the chairman's suggestion, I would say that under "General," two items have been added, namely (h) and (i), incorporating the method of a suspended signal mast and a dwarf signal mast, this being additional to that already approved by the association for the previous sub-committee.

Mr. Stevens: I cannot help recognizing the fact that in paragraph B the association decides for the upper right hand quadrant. I hope the cause of alternating current signaling is not going to be stopped on railways using lower quadrant signals. I know of one very important installation which is being made to-day with lower quadrant signals, and it seems to me that this is an important thing to recognize.

Mr. Balliet: The committee chairman's answer is that the recommended practice of the association is the upper right hand quadrant, and he has no alternative but to incorporate that in the requisites.

Mr. Shaver: Is it the intention of the committee to fill in the blanks?

Mr. Balliet: It was the intention in writing up the requisites for this particular report first to give the manufacturers an outline of what we require, then, as we have developed in the other work, to go back and by a series of conferences to fill in the blanks, not as an order but as a guide or indication as to what is desired. In other words, the alternating current signal installations are not, as we see it, in such shape that we should make rigid specifications, but rather put it in the shape of a requisite and tell them what they must meet or what they should meet.

Mr. Morrison: The development of alternating current signals is such that it would not be desirable to fill in those blanks at the present time. I know that as to each new alternating current installation that we have put in, we have made vast changes in current consumption especially. Do you think it possible that the upper quadrant signal, coated with sleet and ice, would increase the load on the brade 50 per cent? That, it seems to me, would be large.

Mr. Balliet: I might say that it has been tried, and found very close to 50 per cent in one or two cases.

Mr. Morrison: I don't think we will ever get three per cent excess load on the a. c. line.

Mr. Balliet: The committee is ready to say 25 per cent is what should have been inserted there.

Mr. Patenall: I would like to suggest that the committee use the words "Excess weight on the arm" as best defining what they mean.

Mr. Waldron: Under paragraph (b) section D "To be capable of continuous operation at 10 per cent under normal frequency," wouldn't you change that and make it "10 per cent over normal frequency?"

Mr. Saunders: I think we ought to have 10 per cent variation either way. In the construction of signals you are limited to two frequencies, 25 and 60. When you come to get 25, it is a hard frequency to maintain by a motor-generator. You have to select between 23 and 26, on account of the commercial problem. You cannot get a machine that will deliver exactly 25.

Mr. Balliet: The committee will say plus or minus.

Mr. Stevens: I move that paragraph as to the 90 degree indication be eliminated, first, because it cannot be done, and second, for the reason that it has no place in the specifications.

Mr. Patenall: If we accept that paragraph, there is one word which we shall have to leave out; that is the word "guarantee."

The President: It seems to me that that paragraph does not relate to the construction of a signal, but to the construction of a system.

Mr. Stevens: It is a question of practice, and that is the special reason about which I object.

Mr. Balliet: The committee is not willing to eliminate it. We would like to have a vote.

Mr. Beaumont: The word "guarantee" is strong. We can not absolutely guarantee anything. We can strive to make it that way.

Mr. Balliet: There is only one thought that the members should take with them: you cannot put a circuit break on an electric light to control the signals.

Mr. Shaver: I wish to ask if this completes the relay specification or if the committee expects to cover it in the general specification of relays as to contact and the like—general construction?

Mr. Balliet: The committee has in mind, as previously stated, that we are not ready to tie any manufacturer down to manufacturing details. That would without doubt very materially retard the art. The committee prefers to tell the people who propose to sell us alternating current apparatus, for the time being, at least, what we require to perform the work. We are in a little different position from the other committees in that particular field, and it would be a hardship to now limit the manufacturer to rigid specifications.

Mr. Balliet: The committee will submit at the June meeting transformer specifications. We had them ready for this meeting, but we had so much matter that it was not proper for us to submit them.

W. N. Manuel (G. R. & I.): I think in connection with Secondary Supply that it might be well to consider the advisability of the committee getting up some form of contract between the railway company and the company furnishing the power.

Under the head of "Line Wire for Low Voltage Circuits," it is proposed that the cross-arm for the low tension line be left to Committee IV, and it will be suggested that the high tension cross-arms be according to the National Electric Light Association standard. They have a book of specifications that covers practically every state in the Union for high tension work.

Under "Locks," something should be done with the word "purchased." I believe it should be "and shall be furnished by blank," instead of "purchased."

Under "Paint," "including" and "except" between the words "woodwork" and "blades," should be omitted, because we have instructions for painting blades.

WIRES AND CABLES.

The committee was instructed to (a) continue investigation and tests with a view to improving the specifications for mineral-matter, rubber compound, insulated signal wire; (b) prepare specifications for copper-clad steel bond wire; (c) prepare specifications for 30 per cent conductivity, hard-drawn copper-clad steel line wire; and (d) prepare specifications for wire and cables for high-tension circuits. Suggestions as to conditions and requirements to be met should be obtained from the committee on Electric Railway and Alternating Current Signaling. (This committee was asked to have the specifications for copper-clad bond and line wire ready for discussion at the March meeting.)

W. H. ELLIOTT.

Chairman Committee on Wires and Cables.

The committee submitted for consideration a preliminary report comprising recommended specifications for 30 per cent conductivity, hard-drawn, copper-clad, steel line wire; copper-clad steel bond wire; and armored submarine cable for high tension circuits.

The committee consists of W. H. Elliott (N. Y. C. & H. R.), chairman; E. L. Adams (L. S. & M. S.), vice-chairman; W. L. Dryden (S. I. R. T.), A. B. Himes (B. & O.), J. D. Phillips (P. & R.), D. W. Richards, Jr. (N. & W.), E. L. Watson (P. R. R.), J. V. Young (B. & M.), and J. W. Young (Erie).

Discussion on Wires and Cables.

Mr. Elliott: The committee would like to submit recommended specifications for "30 per cent conductivity hard-drawn copper-clad steel line wire." This specification is practically that of the specification for copper-clad steel line wire, with weatherproof breaking, with the weatherproof breaking omitted, with this exception: That the requirements as to breaking strength in pounds, weight per thousand feet in pounds and resistance in ohms per mile at 68 deg. F, has been included for the several sizes of wire. In our opinion this specification is in form to be formally adopted by the association and is satisfactory to the manufacturers.

Mr. Elliott: I move that we eliminate, under paragraph 1, the word "but," so the paragraph will read: "Having 30 per cent of the conductivity of that of pure copper."

Mr. Saunders: There is some criticism about the 30 per cent, that the table figures out an average of 26 per cent conductivity. I think it is misleading to call a specification something that it is not.

Mr. Elliott: I would like to say that this table of resistance is that which was given by the manufacturer and is based not on the exact standard, but on a standard with 98 per cent conductivity of the copper, and the committee thought it advisable to take the resistance which the manufacturer was giving for this trade name of 30 per cent conductivity of the wire.

Mr. Saunders: Figuring on conductivity of 97 per cent standard for hard-drawn copper wire, it averages 27 per cent conductivity, not 30.

Mr. Elliott: The manufacturers claim they are not able to draw wire to the exact conductivity, and they will furnish anything having a conductivity 5 per cent of that specified. They say the difficulty in making to an exact resistance is so great that if it is thirty or thirty-five or forty they will ship it out on an order for thirty or more; that it is too difficult to get the exact resistance.

It is my understanding that if the wire has a lower conductivity than the table it would be satisfactory from the standpoint of conductivity. On the other hand, a wire with lower conductivity, having more copper in proportion than steel, is of slightly less tensile strength, and this table is that which was agreed upon between the committee and the manufacturers, as being what they could meet.

Mr. Denny: As I have understood the situation, there is no difficulty in securing 30 per cent wire; and if that is so, it would seem the last table. "Resistance in ohms per mile at 68 deg. F.," should read "Not more than."

Mr. Stevens: If it is possible that the manufacturing of this wire introduces two difficulties in producing this special conductivity, I should think it would be the duty of the committee to decide on a permissible variation from this conductivity rather than give a conductivity which is not 30 per cent.

Mr. Beaumont: For the past several years we have been using 40 per cent copper wire. The manufacturers have no difficulty in making wire that is actually 30 per cent conductivity. There is no reason why a manufacturer should furnish a 27 per cent wire on a 30 per cent specification. If they are doing that, we want to know it. To my mind this is a case where the manufacturer should be straightened out by the association. I don't believe it is up to us to specify 27 per cent, but to make the 30 per cent specification and compel the manufacturer to come up to it.

Mr. Denney: In the same connection, I call attention to paragraph 9. It means, in substance, that if a coil does not meet the requirements, you can cut off a piece, and see if the piece you have left meets the requirements. I would like to ask if that was put in at the suggestion of the committee or the manufacturer.

Mr. Elliott: This paragraph is satisfactory to the manufacturer. He withholds the privilege to withdraw the coil, or to have the piece cut off until it is of the proper conductivity; the fact of the matter being that in manufacturing copper ingot the practice is to draw down more of it in the center of the length, and the practice at the factory is to cut off pieces from the ends until a proper gauge of copper is had.

Mr. Denney: Are you reasonably sure that the variation exists only at the end of the coil? If that is so, and the manufacturers know that, they could cut off those pieces and give you a coil that was of the resistance specified. The paragraph, to my mind, discredits the proper kind of wire; that is, your conductivity may be the result of various sections of steel and copper through the entire length, and if by chance you happen to strike the right conductivity, the result is satisfactory.

Mr. Elliott: The tests made at the factory show that a certain thickness of copper is reached by cutting off the ends, and that that thickness is continued—it is practically even until you approach the other end.

Mr. Denney: Would the committee consent to withdraw that paragraph?

Mr. Elliott: That paragraph is put in really as a help to the manufacturer, to let him sell such coils as he desires. This particular paragraph is not objected to by the manufacturer, although it was changed in its wording slightly to meet his objection.

Mr. Saunders: The purchaser is protected in the next page, where we have the minimum length of coil guaranteed.

Mr. Waldron: Is there anything in these specifications to guarantee that the wire will be copper clad? As I read them, the manufacturer might make the wire with one side steel and the other side copper. There is no guarantee that the copper was surrounding the steel and that all the parts of the copper would be practically of the same thickness. It would appear to me that the manufacturer could beat the specification at almost any place he saw fit.

Mr. Elliott: The thickness of the copper coating is sufficient to be determined by the eye. It is very readily perceptible on filing an end of the wire. It is also more distinctly brought out by examining the squared end under a magnifying glass. A visual examination is so much more definite and distinct than any chemical test that can be devised, that it is by far the best method to examine the end of the wire and see what the thickness of the copper is.

Mr. Waldron: I am inclined to doubt the advisibility of testing in that manner. The copper being so much softer than the steel, it seems to me that it is liable to overlap the steel and show a thicker coating of copper than would otherwise be the case.

Mr. Elliott: I am sorry I did not bring with me samples I had of 30, 35 and 45 per cent wire, exactly for that purpose. I not only had the ends squared up and polished, but the iron cored out to show the thickness of the copper. There is no difficulty in detecting by your eyesight whether the coating is thin and its approximate thickness.

Mr. Denney: The committee has better covered Mr. Waldron's point in the specification for the copper clad steel bond wires.

Mr. Elliott: The committee will add the word "concentrically" to clause 2 of the specification for bond wires.

Mr. Saunders: I believe there should be some allowable variation in the diameter and weight for any given length.

Mr. Denney: In addition to that the breaking stress should specify that the weight "should not be less than," and the resistance "should not be more than."

Mr. Elliott: There was some difference of opinion in the committee as to whether or not it was advisable to put in different variations, both in the breaking strength and limit of the resistance, and it is deemed best to allow the purchaser to use his judgment if he desires to accept anything else than the exact specification requirement.

Mr. B. H. Mann: I think the committee ought to go a little deeper into the matter covered in section 9. The specification for copper wire was a long standing controversy between the purchaser and the manufacturer as to how much should be cut off from each coil, because they wanted a uniform product. We got a poor quality of wire for a distance of at least 24 feet, because back of the jaws, for a certain number of feet, the wire was not uniform. We buy copper wire to secure in the life of the wire the service and strength which should be given by a copper wire, but if there is a piece that does not have the same thickness of copper as the rest of the wire, that is a weak point, and the life of the wire is equivalent only to the life of its weakest part. I do not see why we should not ask this firm to cut a certain number of feet off each coil, allowing them to try out its conductivity and keep on cutting back until the thickness of copper is enough to give the 30 per cent conductivity.

Mr. Elliott: Clause 9 is put in to help out the manufacturer so that if at his option he desires by any means to make the coil meet our requirements he can do so.

Mr. Mann: I do not think we should put in a clause to help the manufacturer. The paragraph implies on its face that the end of the coil is not the same as the rest. There is a piece on the end of the coil which is apt to have a thin coating of copper.

Mr. Waldron: The manufacturer does not know how much of the end of each coil he must cut off until he gets to the place where the copper is of uniform thickness. And if he does he then certainly can supply coils with this uniform thickness throughout the whole coil as he will cut off as much of the end as may be effective. I think that all parts of the wire should have a uniform thickness of copper, and that some method should be provided for guaranteeing that amount of copper being put on the steel wire.

Mr. Denney: I agree with Mr. Waldron, there should be a specification for a minimum coating of wire. We will presume that the ends of the coil are smaller and there is a little heavier coating of wire than called for by the specification, then you would not detect the thin coating of copper at all, because the coil would be satisfactory.

Mr. Mann: We can cut these ends off in this particular case and there is very little lost; the ends can be sold for bond wires. I do not think the manufacturer can raise the price.

Mr. Elliott: The only points which have been brought up that our committee should seriously consider are the maximum-minimum limits in breaking strength and the addition of "not more than" in the insulation resistance table. If desired, we can check this table and make it specific, exacting 30 per cent.

Mr. Denney: I move that it is the sense of the meeting that paragraph 9 be eliminated. Motion seconded and carried.

Mr. Mann: I move that it is the sense of the meeting that an item be put in the specification that defective ends be cut off before they are put up for test at all.

Mr. Elliott: It is the regular practice of the manufacturers to cut off 20 to 30 feet. It sometimes happens, as previously explained, that the does do draw the material a little finer than intended and that the desired thickness of copper is obtained at a little further distance than the one that is ordinarily obtained. For that reason, clause 9 is expected to cover that contingency. The manufacturer, of course, aims to get wire of the standard conductivity.

Mr. Denney: I ask the chairman if the committee has looked into the matter of the minimum coating of copper at any point on the wire?

Mr. Elliott: We got very complete data on that point and decided that visual examination was sufficient to tell whether copper was evenly distributed around the coil.

Mr. Denney: Will that be embodied in the specifications? I think there should be a specification to show a requirement for a minimum coating of copper.

Mr. Elliott: We did not think it necessary to tell a man to look at it to see if it was evenly placed around the core.

Mr. Elliott: The difference between the 30 per cent and 50 per cent conductivity is only about .015 or .020 of an inch, and it is very difficult to tell what the exact conductivity is on examination of the sample. Suppose we find the product runs very regularly, but that the copper is thinner on the ends, and the manufacturer cuts off sufficient on the end to get the required thickness. That, as I recall it, is obtained by cutting off about 20 feet. The coils for No. 9 wire will run 2,000 feet, so you see that the length in which the wire is slightly thinner than the required thickness, which I believe is $\frac{1}{32}$ of an inch, is very small compared with the length of the wire.

Mr. Waldron: Has the committee investigated the chemical tests in connection with determining the thickness of the copper?

Mr. Elliott: It was found that the amount of copper dissolved was .002 grams, and the amount of copper to one foot of the wire was about 7.5 grams which, with the strength of acid proposed, would require a test of 26 days to show whether the amount of copper had been placed around the wire. We thought it was not a very satisfactory test, particularly as the acid was so weak the iron would scarcely be affected and the thickness of copper and its concentric arrangement around the core could be more readily determined by the eye.

Mr. Denney: Why is it necessary to vary from 30 per cent to 50 per cent in the conductivity of bond wires?

Mr. Elliott: The manufacturers claim that the bond wires are a by-product, that they use the scrap ends of the wire for line wire and other purposes, having a conductivity anywhere between 30 and 50 per cent, and that for bond wire purposes one answers just as well as the other, and that the cost would increase it too much if they had to cut all line wire material to serve the purpose. There is enough of the by-product to supply the demand for the bond wires.

Mr. Denney: I know a manufacturer who said that if the specification started on that basis the idea was obsolete as the requirements had become so great they had to draw a wire especially for bond wires and cut it up.

Mr. Elliott: I have a letter from a manufacturer stating just what I said, and it seemed to the committee that the point was good, that for bond wire purposes a conductivity between 30 and 50 per cent was immaterial, and that on account of the wire being cut up short, it was very difficult to make an insulation test and that they would be accepted without that and that practically it was not worth while to pay a manufacturer a higher cost to cut up material of a good conductivity.

Mr. Saunders: There are two things you require in a copper wire, a certain conductivity and a certain strength, and I notice that the previous specification allows the average of the double test. I think that is right. I think the same applies to paragraph 9 here.

Mr. Denney: Why did the committee specify that the wire shall be put up in bundles of 100 and 300, instead of one size?

Mr. Elliott: That requirement is copied from the iron bond wire specification, which is adopted by the association.

Mr. Elliott: The specification for "Armored Submarine Cable for High Tension Circuits" is practically a combination for the high tension aerial cable, with requirements that apply to submarine low tension cable. This specification is required to accompany it by a part of the a. c. specification regarding submarine cable for high tension circuits, and the only clauses

here which differ from specifications previously adopted are here submitted. It is believed that the requirements are those covering the best practice and would require the giving of a satisfactory article.

Mr. Elliott: The intention of the tables on "Electrical Tests of Rubber Insulation" and "Temperature Coefficient of Resistance" is to make this part of the specification for mineral matter, rubber compound, insulated signal wire so that an inspector in testing wire at the factory may make the curves of the resistance found to standardize the results. If the correct coefficient or standard coefficient is not used in correcting for temperature, the results will so vary as to make the resistance uncertain. Each manufacturer now uses his own temperature coefficient and the results arrived at at each factory are not comparable with those in another factory and for this reason it is desirable that a standard be adopted. This standard is what is being used by the electrical department of the New York Central and has been followed by them for a number of years and has been copied by the manufacturers from whom they have purchased wire, so that we believe we are safe in specifying the table as given here.

STANDARD DESIGNS.

The committee was instructed to (a) continue preparation of standard designs; (b) devise and use on drawings a system of symbols (preferably based on the drawing numbers) for designation of parts; and (c) prepare design of detector bar.

The committee submitted for consideration drawings as follows: terminal block (1056); rocker shaft arms (1060);

J. C. MOCK.

Chairman Committee on Standard Designs.

rocker shaft bearings (1061); rocker shaft, assembly and details (1062); and detector bars for mechanical interlocking (1098 and 1099).

The committee consists of J. C. Mock (M. C.), chairman; J. A. Peabody (C. & N. W.), vice-chairman; G. E. Ellis (K. C. T.), F. P. Patenall (B. & O.), A. H. Rudd (P. R. R.), M. E. Smith (D. L. & W.), R. E. Trout (U. P.), and J. C. Young (U. P.).

Discussion on Standard Designs.

Mr. Mock: The binding post is to supersede plan 1055, which showed a U bolt in the terminal block that was found to be a little too light and rather unsatisfactory.

Mr. Fugina: I do not understand why a U-bolt would not make a better proposition. You are putting extra connections in which you could get away from if you had a U-bolt.

Mr. Mock: In the first place this can be used to separate the circuits and is easier to manipulate, less liable to break when mounting it on the boards, and has the advantage of being able to connect several of the lines. If mounted vertically the top lines can be connected. It is more flexible as a standard and not any more expensive.

Mr. Denney: I move the approval by this meeting of plan 1056.

Mr. Elliott: Would it not be better to show the connecting links above the open space for the wire; with the link in the lower position underneath the wire it is necessary to move the wire each time the link is open to test the circuit.

Mr. Mock: That is the way the draftsman chose to show it. You can place it any way you like. We do not require that you should place the link in the top.

The president put the motion to vote and plan 1056 was approved.

Mr. Mock: This plan of rocker shaft arms relates to the detail of the bending of the arm of a rocker shaft and has been gone into very carefully. The New York Central Lines have a standard which has a straight bend. The Pennsylvania has a rocker shaft arm with a curved bend. This is more or less of a compromise, and gives a greater clearance. It has been tried out and found to be the best bend for this length of arm.

Plan 1060 was approved.

Plans 1061 and 1062 were approved.

Mr. Mock: We have had a specification on detector bars by committee on Mechanical Interlocking, and they recommended a bar as shown on plate 1099. That is a straight bar, with a part of the plate to be counter sunk for rivets and the other part to be straight holed. This committee has had on its program the design of a detector bar, but in the reguiar program of the work, the committee offers these bars. We have had some criticism from the committee referred to, because we have recommended the bar shown in plate 1098. The reason for our designing this bar with a bend rather than a straight bar is that it is a better mechanical device, has fewer parts and is quite as efficient.

Mr. Denney: These plans show ⅜-in iron bars. Is there any reason why the plans should not give the dimension that is shown as ⅜ inch in letters and then show ⅜ inch, $\frac{7}{16}$ inch or ½ inch, as specified if the hole is made longer, with ½-inch bar? I think there should be a provision of some sort for a shorter bar than 55 ft. If you are going to use 50-ft. or 45-ft. bar, there is no reason why two of these sections cannot be kept standard.

Mr. Mock: The other plan, 1098, is a straight piece of variable length, although shown in this diagram as 18 ft. 8 in. The specification which we are permitted to make will be that two of the bars will be 18 ft. 8 in., offset at one end, to be bolted to the other piece, a straight bar of variable length. The two-piece bar will always be as shown in No. 10983.

The committee believes that a mechanical bar ⅜ in. thick is sufficiently heavy. As you add to the weight, of course you add to the work put on the lever, and I think they are plenty heavy enough now with 40-ft. bars. As we increase the length we increase our troubles from operation as well as maintenance. The power mechanism should be all operated with a bar of heavier construction, but then the question comes in whether it would not be better to put in more guides and keep one standard, maintain the number of guides and vary the weight of your bar. We felt that was the right thing for mechanical interlocking, but would be glad to have you give us a guide as to what you prefer.

Mr. Denney: We are using a half-inch bar and I do not see why this plan should not be revised to provide for ⅜-in., $\frac{7}{16}$-in. and ½-in. bar, and, also, in place of the 18-ft. 8-inch dimension on the straight bar, to provide for any length of dimension or for the 18-ft. 8-in. or 5-ft. bar that we think necessary. In other words, one plan would do for any weight or any length of bar.

Mr. Elliott: I make a motion to that effect.

Mr. Stevens: Why could not we leave the thickness of the bar blank? Mr. Denney wants three sizes, some one else will want four.

Mr. B. H. Mann: We have been buying R. S. A. bars for three or four years. While perhaps it does not make much difference when you buy bars from the signal company, it makes a good deal of difference in the field, for repairs can be very much better done and done by the average man with a very few tools, if you use this as a standard. A butt straight end splice can be made by a short piece of bar. We have used our present standard for three years and there is no good reason for changing it. The Mechanical Interlocking Committee has gone into the matter thoroughly and the Power Interlocking Committee has tried to conform in this particular.

Mr. Shaver: Is the bevel the same as we have been using?

Mr. Mock: The bevels vary. This one has been in use quite extensiely. If we get enough bevel that is all we need. The stronger the bar the less the bevel. With the lap joint the less bevel the better, because you ought to cut off all the bevel in order to lap and get the full strength of the bar.

Mr. Fugina: Do I understand it is proposed to make the length 55 ft.?

Mr. Mock: There was an error on the part of the drafts-

man in putting the dimension on the last piece—it should have been left blank. The drawing shows with the three sections put together we would get 55 ft.

The president: The motion was that the thickness of the bar should be covered by a note providing ⅜ in., $\frac{7}{16}$ in. and ½ in. and that it is considered preferable that no length should be given. This motion was made by Mr. Elliott.

Mr. Shaver: There is a difference of opinion—certainly ⅜ in. is not heavy enough for power plant, and some claim that the ½ in. is too heavy for a mechanical plant; can we compromise on $\frac{7}{16}$?

Mr. Mock: If we have a ⅜-in. bar why not go to the ½-in., instead of the intermediate $\frac{7}{16}$ in.?

Mr. Elliott: I would eliminate the $\frac{7}{16}$ in. and make it ⅜ and ½ in.

The President: Mr. Elliott wants the motion modified; does the seconder agree?

(Seconder agreed.)

The President: The motion will be that the thickness of the bar shall be either ⅜ in. or ½ in. and the length of the straight piece will not be given.

(Motion carried.)

Mr. Manuel: In connection with the driving piece, I believe it would be a good thing to make the ends square, that is, the taper ends square and increase the thickness to, say ⅝ in., so that it would form a stop when used on a bar that is controlled by running plates.

Mr. Mock: The committee hopes to be able to present at the June meeting a complete curve sheet of torque for semaphore spectacle with the plates, without the plates, with the various kinds of plates, and with the various maximum pitch, combined with the plates, and without the plates. With this information, we think the proper specifications for semaphore spectacles can be arrived at; at least, it will be information upon which a specification can be made with certainty.

A sketch of a scheme suggested by Mr. Mock for attaching relay boxes to terminal posts and a proposed design for the base, was considered informally by the meeting.

STORAGE BATTERY.

The committee was instructed to (a) review in consultation with representatives of manufacturers adopted specifications and designs for storage batteries and recommend such revisions as may be necessary to make them complete; and (b) investigate jelly electrolyte. (This committee was requested to have some matter under (a) ready for discussion at the March meeting.)

The committee held a joint meeting with manufacturers in Buffalo on January 10, 1912. Methods of charging by the charging line system, the portable battery system, and the primary battery system have been investigated. The association was requested to consider corrections in the present specifications for portable storage batteries.

The committee consists of R. B. Ellsworth (N. Y. C. & H. R.), chairman; G. E. Beck (L. S. & M. S.), J. Fred Jacobs (C. R. R. of N. J.), T. L. Johnson (D. L. & W.), A. H. McKeen (O. W. R. & N.), and A. H. Yocum (P. & R.).

Discussion on Storage Battery.

Mr. L. R. Mann: In the progress report it is stated that the preliminary reports received in regard to jelly electrolyte were inconsistent with each other, and further investigation was made. I ask the committee if the reports received on jelly electrolyte were all for automatic block signal service?

Mr. Elsworth: The use of the jelly electrolyte in signaling is very limited. I believe there are certain batteries on the Illinois Central and the Missouri Pacific. We cannot find that they have otherwise been used to any considerable extent, and the theoretical consideration of this type of electrolyte and the opinions of the manufacturers themselves in all cases justify the reports that we have been able to get at this electrolyte in the limited time at our disposal, and the committee wishes to investigate the matter further before making a definite investigation.

L. R. Mann: When we first started the use of the jelly electrolyte some manufacturers discouraged the idea, however we have had the jelly electrolyte in service for three years and absolutely nothing of a detrimental character has occurred yet.

Mr. Beck (L. S. & M. S.): The jelly electrolyte was introduced primarily to prevent leakage in case of broken jars. The trouble with jelly electrolyte has been the drying out of the jelly and while it does decrease the capacity, unquestionably, of the portable cells that are used in the automatic system service, the capacity is not used in any event, so that the decrease of the capacity does not amount to anything.

R. S. A. COMMITTEE MEETINGS.

Committee VIII, on Electric Railway and Alternating Current Signaling, H. S. Balliet, chairman, will hold a meeting in the French room at the Congress Hotel at 2:00 p. m., Tuesday, March 19, and Committee IV, on Automatic Block, A. T. Shaver, chairman, will hold a meeting on Wednesday, March 20, at 11:00 a. m., in room 1125, La Salle street station.

DINNER TO APPLIANCES ASSOCIATION OFFICERS.

R. E. Belknap, president of the National Railway Appliances Association, gave a dinner at the Blackstone hotel last night to the officers and directors of the association. Following the dinner there was informal discussions of the association's past and future work. There were present as Mr. Belknap's guests, A. P. Van Schaick, T. W. Snow, T. R. Wyles, George C. Isbester, N. M. Herch, C. W. Kelly, H. M. Sperry, J. N. Reynolds and Bruce V. Crandall.

PRESIDENT CUSHING'S DINNER.

President W. C. Cushing gave a dinner last night in the English room of the Congress Hotel to the Board of Direction and the Committee on Arrangements. Mr. Cushing's guests were: Charles S. Churchill, Edwin F. Wendt, George H. Bremner, E. H. Fritch, Hunter McDonald, William McNab, L. C. Fritch, W. B. Storey, Jr., J. B. Berry, Robert Trimble, A. S. Baldwin, C. F. Loweth, F. R. Coates, W. A. Christian, J. B. Cox, E. H. Lee and W. A. Wallace. Mr. Churchill presented President Cushing with the special badge of the association, making a brief speech to which the president feelingly responded.

DINNER OF COMMITTEE ON SIGNAL PRACTICE.

The members of Committee I of the Railway Signal Association, that on Signal Practice, which is composed of the same persons as the committee on Signal Practice of the American Railway Engineering Association, had a dinner in the Green Room of the Congress Hotel last evening. Several persons besides members of the committee also were invited. Among those attending the dinner were the following: L. R. Clausen, C. P. Coleman, F. P. Patenall, W. H. Elliott, C. H. Morrison, W. J. Eck, A. R. Fugina, C. E. Denney, B. H. Mann, Frank Rhea, Azel Ames, A. G. Shaver, M. H. Hovey, T. S. Stevens, E. F. Wendt, C. H. Ewing, C. A. Christofferson, C. A. Dunham, G. E. Ellis, H. S. Balliet, J. C. Young and M. D. Hanlon.

FOREIGN RAILWAY NOTES.

In the Ivory Coast Colony, Africa, a railway is being operated from the port of Bingerville to Macouguie, and extensions inland are projected which will almost double the length of the line.

In French Guinea, Africa, a line is already in operation from the port of Konakry to Kindia, an inland town in the northeast of the colony. This line will eventually be extended to Kouroussa, on the Niger river.

In the island of Reunion, near Madagascar, there is a railway system which runs around the greater part of the island, with the exception of the west coast and a short gap on the northeast coast, where it is intended to link up the existing termini on either side. This line when completed will be about 75 miles long. It is also proposed to extend it along the south coast from the present terminus of Saint Perre to Saint Joseph.

The present position of railway construction in French East Africa may be summarized as follows: In addition to the Dakar-Saint Louis Railway, a line has already been

completed in Senegal between Kayes and Baroueli, a considerable distance in the interior of the colony. This line will eventually be linked up to the Dakar-Saint Louis system by the construction of a railway between Kayes, the western terminus, and a point near Thies, which is northeast of Dakar.

THE EXHIBIT.

That the National Railway Appliances Association has fully sustained its reputation for repeated improvements not only in the number and arrangement but in the quality and variety of the manufacturers' exhibits at its exhibitions cannot fail to be the testimony of all who visited the Coliseum and the First Regiment Armory yesterday.

With reference to the magnitude of the exhibit this year's display fully continues the record of progressive development which has been made in each of the past three years. In 1909, the first year in which the exhibit was held in the Coliseum, only the main floor was required for the display of the latest devices of interest to the railway officers in attendance at the convention. In 1910 the exhibits overflowed into the Annex in the south end of the Coliseum; and last year both the main floor and the annex were occupied, and the balcony as well. This year the balcony has been given over to seats for spectators, from which the attractive general arrangement may be observed to advantage, and in addition the entire main floor of the First Regiment Armory adjoining the Coliseum's southeast corner has been taken for exhibits.

The two buildings afford nearly 54,000 square feet of net exhibit space, which has been divided into 297 spaces. The total number of exhibitors, occupying from one to twelve spaces each, is 189.

Probably the first feature of the exhibit display to arrest the attention of the visitor is the unusually attractive appearance presented by the arrangement plan of the Coliseum as a whole. The aisles in which the various exhibit booths are arranged are formed by a series of square columns finished with burlap colored with a tasteful blend of gilt and light green, and surmounted by large spherical electric lights which furnish a peculiarly soft form of illumination. Each column bears the initials of the appliance association, "N. A. R. A.," within a carved wreath.

For the separation of the booths this year, instead of the familiar styles of railing or partition, there has been used a uniform type of fence, made of wood painted black in imitation of iron picket fence. This, together with the absence of railing in front of the exhibit spaces, adds greatly to the open, airy appearance of the entire group of exhibits.

In the center of the main aisle facing the entrance to the Coliseum is an attractive centerpiece of intersecting arches. Mounted in the uniform columns and under the arch is a convenient sanitary drinking fountain with four bubbling cups.

The exhibits themeselves have been grouped in a general way according to the character of the apparatus. For instance, most of the signal exhibits, which are in great variety, are grouped in the northwest corner of the Coliseum, occupying two aisles south of the main entrance, many of them in actual operation. Other signal exhibits are in other parts of the two buildings.

The Annex is given over mainly to the devices and appliances requiring a comparatively large space for their proper display, such as steel ties, special work, hoists and derricks and track scales. The Armory is principally occupied by the heavier track work exhibits, steel ties, switches, frogs and crossings and manganese special work.

Opposite the entrance is a large sign displaying the names of the exhibitors occuping the Armory, which is reached from the southeast end of the Coliseum through a canvas-covered passageway.

A detailed description of the devices collected at the Coliseum for the inspection of the railway men is of course impossible. Excellent as has been the displays in previous years, those in charge of the exhibit and the individual manufacturers themselves have exceeded their previous efforts in bringing to the fore their latest and best improvements in appliances for the construction, maintenance and operation of railways in accordance with the most approved principles of practice from the standpoint of efficiency, economy and safety.

A marked development of the scope of the exhibits is noticeable in the number of mechanical appliances on view which are less directly connected with engineering department work, than the bulk of the exhibits, such as machinery for the operation of coaling stations and water-softening plants, track scales, water tanks, hoists and derricks.

Another noticeable development is seen in the number of exhibits of special ties and rail joints. Eight different types of special ties, of which the majority are of steel, and some of which included a rail joint feature, were counted in a cursory visit to the exhibit. Eight different exhibits of motor track cars also were observed, some of them including many different types of various kinds of service, including cars especially equipped with apparatus for driving screw spikes.

The exhibitors as well as the visitors are to be congratulated on the complete stage of preparation of the exhibits on the afternoon of the first day. Only a very few spaces were not completely equipped with the devices to be displayed, and while the sound of the hammer was still in evidance during the afternoon in a few cases, most of the exhibits not yet complete seemed to be those of small articles to be easily installed.

The Roadmasters and Maintenance of Way Association has a booth this year in the annex and is keeping open house for roadmasters who visit the exhibits.

The Coliseum and the Armory were opened at 1 p. m. yesterday and hereafter will be open from 10 a. m. to 10 p. m.

A musical program will be rendered each afternoon and evening in the Armory by Brooks' Band.

WILLIAM McNAB ON THE PANAMA CANAL.

William McNab, principal assistant engineer of the Grand Trunk, and a past president of the American Railway Engineering Association, who arrived in Chicago yesterday to attend the annual meeting of the association, returned recently from Panama, where he went to see the Panama Canal. His opportunities for inspecting the canal were most favorable, as he was the guest while in Panama of the officials of the United States Government who are in charge of the construction work.

Mr. McNab had many interesting comments to make regarding the canal, the work on it, and the commercial changes its opening will produce.

"The undertaking may be looked upon as possessing at least, two main features," he said, "first, construction work in general; second, future effect in the economics of commerce.

"In regard to the first, even the most conservative mind must admit that it is, as a whole, a stupendous work—one of the greatest in magnitude and cost in the world's records.

"It was a fortunate thing to have seen it in its present advanced and exposed state, for once it is watered, it is obvious that it will never be unwatered, and all that will

afterwards be exposed to ordinary view will virtually be a vast artificial lake, a canyon river, the upper portions of locks and the face of the concrete spillway and earthen dam.

"It is then that in the minds of some, wonder may arise, —and naturally too,—in regard to justification for the expenditure of so much money on such an apparently simple undertaking.

"The difficulties, however, which have been and are still being contended with, the methods of overcoming such physical conditions in order to complete the work involved, the class of materials used in every branch of the undertaking and the systematic and admirable form of accounting,—the details of all of which are at present exposed to view, and at close range,—are elements which ought to destroy any line of reason for such questioning.

"The history of the old French company's plans and proceedings, as well as the after negotiations which led to the present construction and ownership, are still fresh in the general mind. These events, including the views individually and collectively of engineers, subsequently and specially invited by the president of the United States, on the question of 'sea level,' or 'locks' as well as the after discussions in Congress, need not be referred to, beyond the statement that notwithstanding certain advantages claimed by the 'sea level' supporters, it is not quite clear to any one who has seen and studied the general conditions and taken into account the lengthy time which would have been taken to complete, as well as the almost double cost which would have been required over the lock system, that the adoption of the latter was a wise choice.

"It is rarely that one can see a work of magnitude in which the principles of division of labor are better exemplified than in this canal project. The force works automatically, so to speak, and there did not appear to be the slightest bunching of any part of the labor and plant which would produce waste of time in any other part. The value of conditions represented by such a statement will be appreciated, when one takes into account the great force of men and plant that is employed.

"Among many special features which appeal favorably to the engineer or operating officer of a railway," Mr. McNab continued, "is the admirable system of service tracks, including the switching movements and signaling. Those are matters of operation and work train movements. Much of the success and speed of the work has been dependent on this feature. Then there are the movable steel forms for the concrete masonry, the unique system of watering, and unwatering the locks uniformly, the construction features of the great steel gates and method of hanging and swinging the same. There are also the enormous traveling cranes and concrete mixing plants at various places, and the dam and spillway at Gatun, all of which are on an exceptionally large scale. Fluctuations in Gatun lake, due to floods, are to be controlled by means of this spillway and its openings. The surplus water will pass through the spillway into the original bed of the Chagres river.

"On a large scale also, are aerial cable way conveyors, track lifting machines, earth spreaders and Lidgerwood unloaders, the plan of action in each of these cases leaving little room for anything but favorable comment and criticism.

"There can be little doubt but that the Canal will in general create an entirely new commercial situation. Its operation will not only form new geographical features and substantially modify the complexity of the world's commerce, but it will be an element of such importance, that its influence will be universally felt in a more or less degree in every branch of trade. The north will be nearer and in closer relationship to the south and the south will be closer to the north. The Central American Republics, too, which hitherto may have been an uncertain element in modern business and social life, should naturally fall in line with and share in such development. The fruit districts of Central America and the West Indies will also undergo rapid expansion in meeting the new order of things.

"It is unnecessary to quote the savings in distance in certain existing sailing routes which will be effected after the Canal is in use. Reference to a terrestial globe or a graphic diagram will afford any particular information in that respect, but it is obvious, among other things, that rapid growth of Pacific ports may be looked for.

"I was credibly informed that the Canal will be watered by July 1, 1913, and although it will not receive official opening at that date, this formality will without doubt take place some time in 1914."

IMPROVEMENTS PLANNED FOR BELT RAILWAY OF CHICAGO.

Fourteen of the principal railways entering Chicago have joined in a plan for the joint ownership and operation of the Belt Railway of Chicago for the interchange of through freight in the Chicago terminal district, which will require eventually a considerable amount of construction work in the city. Two additional elevated main tracks are to be constructed between Seventy-sixth street and Pullman Junction by the Chicago & Western Indiana, to be leased to the Belt, and an auxiliary clearing yard is to be constructed at or near South Chicago. Additional trackage and yard facilities are to be constructed for the Belt as the traffic requires, including the elevation of tracks to avoid all grade crossings. Under the provisions of the agreement, the Chicago, Rock Island & Pacific; Atchison, Topeka & Santa Fe; Illinois Central; the Chicago, Madison & Northern; Pennsylvania Lines; Chicago, Burlington & Quincy; Wabash; Erie; Chicago, Indianapolis & Louisville; Chesapeake & Ohio; Grand Trunk; Chicago & Eastern Illinois; Chicago & Alton, and Chicago, St. Paul, Minneapolis & Omaha will become joint stockholders of the Belt, which will continue to lease as at present the Belt division of the Chicago & Western Indiana Railway, an inner belt line extending from South Chicago to Cragin and intersecting all roads entering the city. In addition, the Western Indiana will purchase and lease to the Belt the property of the Chicago Union Transfer Company, including the large modern hump clearing yard in the southwestern part of the city, which now has about 100 miles of trackage and a capacity of 5,000 cars per day and property sufficient to expand the capacity to 20,000 cars per day. The expenses and rentals of the Belt are to be paid by the stockholding roads on a per car basis. The plan will greatly relieve the congestion of the Chicago terminal district by removing to outside yards much of the interchange of through freight now handled at downtown terminals. The negotiations were conducted by W. H. Lyford, general counsel of the Chicago & Eastern Illinois, as counsel for the reorganization committee of the Belt.

CONFERENCES ON SIGNALING IN INDIANA.

The Indiana railway commission will hold a series of conferences during the week of March 25 with steam roads in the state, for the purpose of determining what the railways propose to do with respect to the commission's requirements as to block signaling. The Pennsylvania, Erie, Baltimore & Ohio Southwestern, Evansville & Terre Haute, Chesapeake & Ohio of Indiana and Cincinnati Hamilton & Dayton will be represented. M. H. Hovey consulting signal engineer, will be among the representatives of the commission.

REGISTRATION—RAILWAY SIGNAL ASSOCIATION.

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Poor, C. O., General Railway Signal Co., Chicago, Ill.
Poor, F. A., Rail Joint Co., Chicago, Ill.
Rhea, Frank, Gen. Elec. Co., Schenectady, N. Y.
Sperry, H. M., General Railway Signal Co., Rochester, N. Y.
Thomson, A., Jr., General Railway Signal Co., Rochester, N. Y.
Thompson, H. G., Edison Storage Battery Co., Orange, N. J.
Tratman, E. E. R., "Engineering News," Chicago, Ill.
Underhill, J. Delmar, Okonite Co., New York, N. Y.
Wiley, J. R., Standard Underground C. Co., Chicago, Ill.
Wreaks, Hugh T., Wire Inspection Bureau, New York, N. Y.

NATIONAL RAILWAY APPLIANCES ASSOCIATION.

The National Railway Appliances Association, which conducts the railway supply exhibits in the Coliseum and the First Regiment Armory, is a successor of the Road and Track Supply Association, which had its origin in 1894. At the annual meeting in 1910 the name of the association was changed to Railway Appliances Association, and last fall it was incorporated under the name of the National Railway Appliances Association.

The history of the original association was outlined in an article which appeared in the Daily Railway Age Gazette of March 15, 1910. We print herewith the photographs of the officers and members of the board of directors who were elected at the annual meeting on March 21 of last year.

ROBERT ERNEST BELKNAP
President.

The president of the association, Robert Ernest Belknap, is Chicago sales agent of the Pennsylvania Steel Company and the Maryland Steel Company. He graduated from Johns Hopkins University in 1897, and his connection with railway work dates back to 1898, when he was engaged in building the Eighth avenue and Sixth avenue underground trolley conduits for the Metropolitan Street Railway, New York City, as assistant to the engineer for the National Contracting Company. In 1901 he joined the sales force of the Pennsylvania Steel Company and Maryland Steel Company, and after working in all the different departments, especially the rail, frog and switch departments, billet mill, steel foundry and bridge shop, and the forging, machine and marine departments, he was attached to the general sales office at Steelton. In July, 1902, Mr. Belknap was transferred to the new Chicago sales office as assistant sales agent and western representative, and in 1906 was made sales agent. He is also a director of the T. W. Snow Construction Company and is an associate member of the American Society of Civil Engineers. He became a member of the executive committee of the association in 1908.

A. P. VAN SCHAICK.
Vice-President.

A. P. Van Schaick, vice-president of the association, is district sales agent of the Lackawanna Steel Company at Chicago. For four years he was connected with the sales department of the Pittsburgh Plate Glass Company, Chicago. During the succeeding five years he was president of the W. K. Kenly Company, railway supplies, Chicago.

C. W. KELLY.

S. W. HAYES.

H. M. SPERRY.

T. R. WYLES.

T. W. SNOW.

N. M. HENCH.

JOHN N. REYNOLDS.
Treasurer.

GEORGE C. ISBESTER.

BRUCE V. CRANDALL.
Secretary.

OFFICERS AND DIRECTORS OF THE NATIONAL RAILWAY APPLIANCES ASSOCIATION.

and he has held his present position as district sales agent of the Lackawanna Steel Company for the past two years.

John N. Reynolds, who is treasurer of the association and who until last year had been secretary and treasurer since 1902, is western manager of the Railway Age Gazette, The Signal Engineer and the American Engineer.

Bruce V. Crandall was appointed secretary of the association, effective July 1 last year.

The other members of the board of directors, in addition to the officers, are: T. R. Wyles, second vice-president of the Detroit Graphite Company, Chicago; George C. Isbester, representative Rail Joint Company, New York; S. W. Hayes, president Hayes Track Appliance Company, Richmond, Ind.; N. M. Hench, engineer of railway appliances, Carnegie Steel Company, Chicago; C. W. Kelly, Fairbanks, Morse & Co., Chicago; H. M. Sperry, General Railway Signal Company, Rochester, N. Y., and T. W. Snow, president T. W. Snow Construction Company, Chicago.

THE FOUNDERS OF THE ENGINEERING ASSOCIATION.

On October 16, 1897, the following letter, signed by Harry P. Robinson, president of The Railway Age, was sent to representative railway officers:

"The Railway Age has been asked to take the initiative in a movement for the organization of an association of railway officers connected with the engineering and maintenance of way departments. Nearly all other branches of the service have their representative associations, which are of undoubted value in their respective provinces. In these departments, however, there is no organization between the general engineering societies, which only partially interest railway men, and the Roadmasters' Association, which, from its nature, cannot adequately cover the field.

"The new association, whatever its name might be if organized, would include all officers interested in the construction and maintenance of the track and roadway and the structures associated therewith, whatever the titles of such officers might be on individual roads.

"Will you let us know if you would join such an association if properly organized, and if you would endeavor to attend a preliminary meeting if called to meet in Chicago at some date in the near future?"

The responses were encouraging, and on October 21 of the following year a meeting was held at the Auditorium Hotel, Chicago, attended by the following:

Augustus Torrey (chief engineer, Michigan Central, now deceased); H. A. Kennedy (general superintendent, Cleveland, Canton & Southern); F. E. Paradis (chief engineer, Chicago Terminal Transfer, now district engineer, New York Central and Hudson River); Curtis Dougherty (roadmaster, Illinois Central, now chief engineer, Queen & Crescent); G. W. Merrill (roadmaster, C. M. & St. P.); W. S. Kinnear (principal assistant engineer, Michigan Central, now president Kansas City Terminal, and just elected president United States Realty & Trust Company); J. W. Taylor (chief engineer, Terminal Railroad Association of St. Louis, now deceased); W. E. Emery (roadmaster, C. M. & St. P., now chief engineer Peoria & Pekin Union); E. C. Macy (division engineer, Iowa Central, now with Stone & Webster at Seattle, Wash.); W. M. Duane (roadmaster, Cleveland Cincinnati, Chicago & St. Louis, now a consulting engineer at Cincinnati, Ohio); J. B. Dickson (roadmaster, C. & N. W., now general agent, Erie); L. C. Fritch (superintendent, B. & O. S. W., now chief engineer, C. G. W.); C. A. Wilson (chief engineer, C. H. & D., now a consulting engineer at Cincinnati, Ohio); G. S. Cheyney (general roadmaster, Indianapolis, Decatur & Western); H. W. Church (roadmaster, L. S. & M. S.); G. H. Bremner (assistant engineer, C. B. & Q., now district engineer, C. B. & Q.); and H. P. Robinson (Railway Age).

Of these 17, eight are now members of the American Railway Engineering Association. They are: Messrs. Dougherty, Kinnear, Macy, Duane, Dickson, Fritch, Wilson and Bremner.

A preliminary organization was effected at this meeting, and the name American Railway Engineering and Maintenance of Way Association was chosen. On March 30, 1899, a second meeting, called by The Railway Age, was held at Buffalo, N. Y.; a constitution was adopted and the following officers elected: President, John F. Wallace (assistant second vice-president, Illinois Central, now vice-president, K. C. M. & O., and chairman of the board, Westinghouse, Church, Kerr & Co.); first vice-president, P. A. Peterson (chief engineer, Canadian Pacific, now retired from active service); second vice-president, W. G. Curtis (engineer maintenance of way, Southern Pacific, now deceased); treasurer, W. S. Dawley (chief engineer, C. & E. I., now building the Yunan-Szechuan & Tengyueh, in China); secretary, L. C. Fritch; directors, Augustus Torrey, Thomas Rodd (then, as now, chief engineer, Pennsylvania Lines), D. J. Whittemore (chief engineer, C. M. & St. P., now retired), F. H. McGuigan (Grand Trunk, now president McGuigan Construction Company, Toronto, Ont.), W. K. McFarlin (C. R. I. & P., now with the T. A. Gillespie Construction Company, New York), and Hunter McDonald (then, as now, chief engineer, N. C. & St. L.).

The first convention was held March 14 and 15, 1900, in Chicago, and all subsequent annual meetings have been held there.

OFFICERS AND PAST PRESIDENTS, A. R. E. A.

President—W. C. Cushing chief engineer, maintenance of way, Southwest System, Pennsylvania Lines west of Pittsburgh, Pittsburgh, Pa.

First Vice-President—Charles S. Churchill, chief engineer, Norfolk & Western, Roanoke, Va.

Second Vice-President—Edwin F. Wendt, assistant engineer, Pittsburgh & Lake Erie, Pittsburgh, Pa.

Past Presidents—John F. Wallace, vice-president, K. C. M. & O. and chairman, Westinghouse, Church Kerr & Co., 1899-1900 and 1900-1901; George W. Kittredge, chief engineer, N. Y. C. & H. R., 1901-1902 and 1902-1903; Hunter McDonald, chief engineer, N. C. & St. L., 1903-1904 and 1904-1905, Howard G. Kelley, vice-president, G. T., 1905-1906 and 1906-1907; A. W. Johnston, general manager, N. Y., C. & St. L., 1907-1908; William McNab, principal assistant engineer, G. T., 1908-1909, and 1909-1910; L. C. Fritch, chief engineer, C. G. W., 1907-1911. Walter G. Berg, chief engineer, Lehigh Valley, was elected president for the year 1908-1909, but never presided over a convention, having died in May, 1908.

Directors—A. H. Rudd, signal engineer, Pennsylvania Railroad, Philadelphia, Pa.; W. B. Storey, Jr., vice-president, Atchison, Topeka & Santa Fe Railway System, Chicago; A. W. Thompson, general manager, Baltimore & Ohio, Baltimore, Md.; J. B. Berry, chief engineer, Chicago, Rock Island & Pacific, Chicago; F. S. Stevens, engineer maintenance of way, Philadelphia & Reading, Reading, Pa.; Robert Trimble, chief engineer maintenance of way, Northwest System, Pennsylvania Lines west of Pittsburgh, Pittsburgh, Pa.; J. A. Atwood, chief engineer, Pittsburgh & Lake Erie, Pittsburgh, Pa.; A. S. Baldwin, chief engineer, Illinois Central, Chicago; C. F. Loweth, chief engineer, Chicago, Milwaukee & St. Paul, Chicago.

Treasurer—Geo. H. Bremner, engineer, Illinois District, Chicago, Burlington & Quincy, Chicago.

Secretary—E. H. Fritch, Chicago.

Editor of Publications—W. D. Pence, professor of railway engineering, University of Wisconsin, Madison, Wis.

Committee on Arrangements—F. C. Coates, chairman; Geo. H. Bremner, W. A. Christian, J. B. Cox, L. C. Fritch, E. H. Lee, William McNab, W. A. Wallace.

At the Coliseum

LIST OF EXHIBITORS.

The following is a complete list of all exhibits in place or being installed in the Coliseum and the First Regiment Armory. Spaces numbered from 1 to 224, inclusive, are in the Coliseum, and unless otherwise indicated, the space numbers in the list are in the Coliseum. Exhibits in the Armory are so indicated:

Adams & Westlake Company, New York, Chicago and Philadelphia.—Signal lamps of every description, long time burners, heat resistance glass, etc. Represented by Walter H. Baldwin, G. L. Walters, A. S. Anderson, C. B. Carson, H. G. Turney, W. J. Pierson, F. N. Grigg. Spaces 83-84.

Allith-Prouty Company, Danville, Ill.—Door hangers, floor hinges, store ladders, fire door hardware, merchandise carriers, and hardware specialties. Represented by L. H. Mason, J. E. Moyer and G. A. Miller. Space 96.

American Casting Company, Birmingham, Ala.—National lock joint cast iron culvert pipe. Represented by D. B. Dimick, E. E. Weaver and H. V. Dimick. Space 53.

American Concrete Pile & Pipe Company, Chicago, Ill., and New York, N. Y.—Reinforced concrete culvert pipe and piles. Represented by Charles Gilman, C. F. Quincy, T. W. Snow, A. E. Stokes, W. A. Wallace, O. J. West, H. W. Wilder. Space 48.

Alexander Continuous Rail Crossing Company, Clinton, Ill.—Full-sized crossing. Represented by C. R. Westcot, L. Alexander, P. J. Malon, S. Wagner, Robert Johns. Spaces 231-232-233-234.

American Guard Rail Fastener Company, Philadelphia, Pa.—Vaughan guard rail clamps, anchor guard rail clamps, Vaughan automatic rail anchors, tie plates, guard rail fasteners and splice and rail straighteners. Represented by D. F. Vaughan, Chas. Z. Vaughan and David L. Vaughan. Space 119.

American Hoist & Derrick Company, Chicago, Ill.—Standard and bridge erectors' hoisting engines, moving picture exhibit American railway ditcher. Represented by Frank J. Johnson, W. O. Washburn and W. L. Manson. Spaces 146 and 217-218-219.

American Iron & Steel Manufacturing Company, Lebanon, Pa.—Track bolts, screw-spikes, cut spikes, tie rods, castellated nuts. Represented by Francis T. West and Chas. J. Gadd. Space 109.

American Nut & Bolt Fastener Company, Pittsburgh, Pa.—Bartley fasteners and Bartley self-locking fasteners. Represented by Edwin M. White and Christopher Murphy. Space 146.

American Rail Joint Company, Niagara Falls, N. Y.—Rail joints. Represented by Thos. D. Beddoe. Space 19.

American Railway Signal Company, Cleveland, O.—Electric interlocking apparatus, electric automatic signals, dwarf signals, electric relays and switch locks. Represented by Geo. L. Weiss, H. M. Abernethy, H. D. Abernethy, S. J. Turriff and R. Eiseman. Spaces 21-22.

American Rolling Mill Company, Middletown O.—American ingot iron, corrugated culverts and other pure iron products, sheets, plates, boiler tubes, rivets, etc. Represented by Paul T. De Frees, Ray Fraser, H. W. Force, G. H. Clark, G. F. Ahlbrandt. Spaces 99-100.

American Steel & Wire Co., Chicago, Ill.—American railroad fences, steel fence posts, signal wire, American rubber-covered wire, railroad switching rope, American wire rope, rail bonds and tie-marking nails. Represented by J. W. Meaker, H. A. Squibbs, L. A. Dietrich, Ben. Ryder, A. W. Sprague, A. W. Froude, S. F. Deems, C. H. Longman and L. P. Shanahan. Space 245.

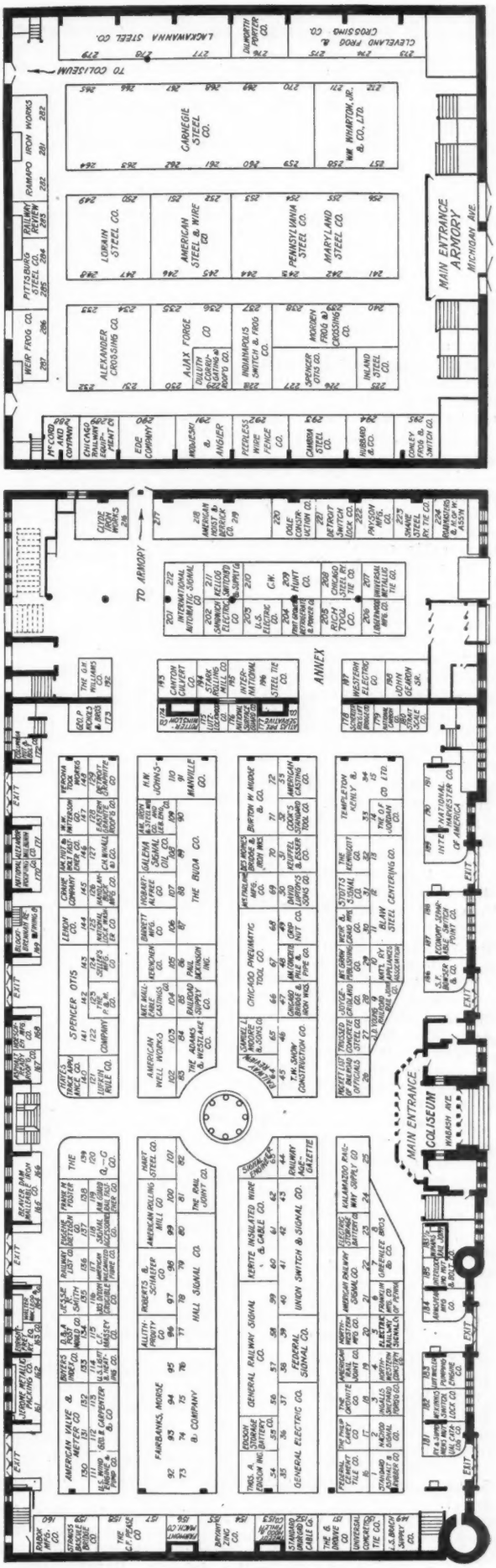
American Valve & Meter Company, Cincinnati, O.—Poage automatic water columns, Fenner drop spouts, Anderson Economy and Buckeye switch stands, Anderson interlocking switch stands and safety switch appliances. Represented by J. T. McGarry and F. C. Anderson. Spaces 130-131-132.

American Vulcanized Fibre Company, Wilmington, Del., and Pittsburgh, Pa.—Original vulcanized fibre for rail joint insulation, steel cross tie insulation. Represented by John Barron. Space 117.

American Well Works, Aurora, Ill.—Deep-well pumps, irrigation pumping machinery, centrifugal pumps, turbine pumps. Rrepresented by Geo. W. Igo, C. B. Spier and A. W. McLean. Spaces 102-103.

Armspear Manufacturing Company, New York, N. Y.—Railway signal lamps and lanterns. Represented by C. K. Freeman and F. A. Buckley. Space 184.

Ajax Forge Company, Chicago, Ill.—Manganese frogs, Ajax manganese guard rail, adjustable switch rods, detector



Floor Plan of Coliseum and Armory, Showing Arrangement of Exhibits.

bars, braces, Ajax rail steel braces. Represented by F. B. Bradley, H. G. Elfborg and H. C. Hutchins. Spaces 230-235-236, Armory.

Asphalt Ready Roofing Company, New York—Protection brand roofing, Hudson brand asphalt felts. Represented by H. H. Huested, W. A. Hemenway and B. Blackwell. Space 167.

Atlas Preservative Company of America, New York, N. Y.—Atlas "A" advertising matter. Represented by R. N. Chipman and B. G. Thompson. Space 177.

Barrett Manufacturing Company, New York, N. Y.—Barrett specification roofs, bridge waterproofing, ready roofing, dampproofing, waterproofing, freight house and machine shop sub-floors. Represented by H. B. Nichols, W. S. Babcock, H. Olmsted Jr., Jack Caldwell, Chas. Gage, A. B. Faison, C. T. Bilyea, J. B. Walker. Space 106.

Beaver Dam Malleable Iron Company, Beaver Dam, Wis.—Malleable tie plates, rail braces and general castings. Represented by F. Bell, J. V. Cowling, F. S. McNamara, E. A. Hawks and D. P. Lamoreaux. Spaces 165-166.

Blaw Steel Centering Company, Pittsburgh, Pa., New York, N. Y., Chicago, Ill.—Steel forms for retaining walls, culverts, concrete pipe, cattle passes, buildings and houses. Represented by J. B. Blaw, A. P. Wilson, Edw. Wilson, T. M. Avery, W. M. Venable, H. B. Loxterman and C. H. Lehman. Spaces 11-12-13.

Blocki-Brennan Refining Company, Chicago, Ill.—Structural iron paint. Represented by James C. Cleary, Gordon Douglass, R. L. Bracher and W. F. Brennan. Space 169.

Bowser & Co., Inc., S. F., Fort Wayne, Ind.—Oil storage systems, self-measuring long-distance pumps, filtration system, etc. Represented by W. T. Simpson, F. T. Hyndman and E. H. Barnes. Space 186.

Brach Supply Co., L. S., New York, N. Y.—Railway signal and telephone lightning arresters, non-air-gap and vacuum types; highway crossing bells, automatic flagmen indications, Solderall and soldering appliances. Represented by Leon S. Brach, Alexander G. Brach and Henry E. Gifford. Space 149.

Bryant Zinc Company, Chicago, Ill., and New York, N. Y.—Locomotive type bells, highway crossing signals, relays, annunciators, channel pins and fibre conduit tools, etc. Represented by Stanley C. Bryant, M. J. Costigan, J. W. Cremerius, A. F. Klink, P. W. Herbst. Space 154-155.

Buda Company, Chicago, Ill.—Motor cars, velocipede cars, electric crossing gate, jacks, track drills, crossings, frogs and switches, bumping posts, replacers, etc. Represented by L. Hamill, J. L. Artmaier, J. J. Gard, J. T. Harahan, Jr., A. R. Dyer or M. E. Towner. Spaces 87-88-89-90.

Buyers' Index Company, Chicago, Ill.—Book "Railway supply index—Catalogue." Represented by Lloyd Simonson, H. E. Frame, Alexander Smith, Norman F. Rehm, D. J. Beaton and F. B. Cozzens. Space 133.

Cambria Steel Company, Johnstown, Pa.—Rails, 100 per cent rail joints, Morrison guard rails, wire and wire products, heat-treated axles. Represented by J. Leonard Replogle, E. F. Kenney, Andrew Morrison, C. B. McElhaney, C. J. Ellis and H. P. Hubbell. Space 293, Armory.

Canton Culvert Company, Canton, O.—Acme and Imperial corrugated No-Co-Ro metal culverts, Duro perforated corrugated No-Co-Ro metal railway drains, etc. Represented by Perry Van Horne, Charles W. Davis and J. A. Laird. Space 193.

Carey Company, Philip, Cincinnati O.—Carey's flexible cement roofing application of waterproofing materials to concrete work, damp-proofing of concrete walls, asbestos and 85 per cent magnesia products, roofing paints, metal paints, etc. Represented by D. R. Warfield, Frank Carter, N. S. Kenny and E. S. Main. Space 17.

Carnegie Steel Company, Pittsburgh, Pa.—Carnegie steel switch ties, frogs, switches, etc.; Duquesne rail joints, steel sheet piling, steel wheels. Represented by N. M. Hench, C. F. W. Rys, A. R. Archer, Robert Coe, G. E. Dix, C. B. Friday, L. S. Thomson, G. W. Landrus, P. W. O'Brien, J. B. Arnold, W. H. C. Carhart, H. C. Griswold, D. E. Sawyer, E. B. Eddy, O. W. Baker, B. E. Hamilton and Fred R. Ohl. Spaces 259-270, Armory.

Carpenter Company, Geo. B., Chicago, Ill.—All kinds of bell rope, transmission rope, wire rope blocks, chain hoists, belting, packing and wire rope. Represented by W. Sosthein, C. H. Gleason. Spaces 112-113.

Chicago Bridge & Iron Works, Chicago, Ill.—Elevated tanks, bridges, retorts and coal chutes. Represented by M. J. Trees, E. G. Ladd, C. M. Ladd, C. S. Pillsbury and G. T. Horton. Space 47.

Chicago Pneumatic Tool Company, Chicago, Ill.—Rockford railway motor cars for section, inspection and signal work, motor car with generator for driving electric drills for spike driving, electric drills for spike driving. Represented by C. E. Walker, J. T. Hume, C. B. Coates, C. B. Stevenson, T. E. Buck, E. S. Cole and E. Aplin. Spaces 66-67-68.

Chicago Railway Equipment Company, Chicago, Ill.—Brake beams, Monitor bolsters, Creco side bearings. Represented by C. H. Williams Jr., F. T. De Long, Geo. N. Van Sweringen, E. F. Leigh, R. S. Deacon, C. S. De Long and Ernest Le Beau. Space 289.

Chicago Steel Railway Tie Company, Chicago, Ill.—Steel railway tie. Represented by J. F. Inglesby, W. E. McKee and J. A. Pement. Space 208.

Cleveland Frog & Crossing Company, Cleveland, O.—Hard Service frogs and crossings, rolled manganese frogs and crossings, switch stands, guard rail clamps, switches, guard rails, tie rods, rail braces. Represented by G. E. Lucas, George Stanton, L. G. Parker, George Arnold, G. A. Peabody and S. Balkwill. Spaces 273-274-275, Armory.

Clyde Iron Works, Chicago, Ill.—Erectors' hoist, drag line bucket model, blocks and sheaves. Represented by A. E. Holcomb and G. P. Miller. Space 5.

Columbia Nut and Bolt Company, Inc., Bridgeport, Conn.—Columbia lock nuts, castle nuts. Represented by Fred Atwater and John E. Eipper. Space 172.

Conley Frog & Switch Company, Memphis, Tenn.—Conley patent frog, Dixie rail brace, manganese track work. Represented by J. E. Conley, F. W. Lange and Fred C. Taylor. Space 295, Armory.

Cook's Standard Tool Company, Kalamazoo, Mich.—Cook bonding drill, Climax heavy duty track drill, Magic grinder, Magic chuck, Magic bits, Standard jacks, Standard guards. Represented by Eugene Cook, F. C. Butler, H. M. Buck and Edw. B. Cook. Space 52.

Crane Company, Chicago, Ill.—Special valves for creosote, zinc, chloride, Crane tilt steam traps, special valves for railway and locomotive service, malleable and cast iron fittings. Represented by F. D. Fenn, G. S. Turner and F. C. Sabin. Space 145.

D. & A. Post Mold Company, Three Rivers, Mich.—"D. & A." 10-post machine, anchor post molds, special line post molds, "D. & A." cement posts and sections, post reinforcement, tie wires, etc. Represented by G. H. Dougherty, L. R. Dougherty, A. E. Armstrong, O. Dougherty and J. W. Armstrong. Space 134.

Dietzgen Company, Eugene, New York—Complete line of transits, levels, rods, tapes, poles, filing devices and other supplies used by engineers. Represented by W. E. Cook, W. O. Phillips, W. H. Lerch, G. C. Moore, C. F. Cole and T. D. McElhiney. Space 137.

Detroit Graphite Company, Detroit, Mich.—Paint for buildings, bridges, boats, cars, etc. Represented by T. R. Wyles, L. D. Mitchell, E. Booth, A. H. Kuerst, J. J. Hogan, B. O'F. Randolph and J. T. Dinkgrave. Space 129.

Detroit Switch Lock Company, Detroit, Mich.—Self-locking switch stand. Represented by A. Kaltschmidt. Space 221.

Des Moines Bridge & Iron Company, Pittsburgh, Pa., and Des Moines, Ia.—Photographs of water towers, formed spherical sections of tank bottoms and slide rule calculators. Represented by Robert W. Baily, W. W. Hendrix, W. H. Jackson, G. A. Smith. Space 70.

Paul Dickinson, Inc., Chicago, Ill.—Dickinson cast iron smoke jacks, Dickinson sheet iron ventilators, Dickinson cast iron chimneys, Dickinson cast iron ventilators. Represented by J. A. Meaden, A. J. Filkins, Geo. M. Kenyon and Wm. H. Dayton. Space 86.

Dilworth, Porter & Co., Ltd., Pittsburgh, Pa.—Tie plates and spikes. Represented by Wm. Goldie, Jos. Dilworth, T. C. Coleman, W. F. Schleiter and Chas. Johnston. Space 276.

Jos. Dixon Crucible Company, Jersey City, N. J.—Graphite paint, crucibles, graphite productions. Represented by E. R. Smith, H. W. Chase and R. R. Belville. Space 116.

Drouve Company, G., Bridgeport, Conn.—"Anti-Pluvius" puttyless skylights, "Straight-Push" sash operator. Represented by William V. Dee and R. S. Adam. Space 151.

Duluth Corrugating & Roofing Company, Duluth Minn.—Corrugated galvanized iron culverts, portable steel tool house. Represented by James W. Walker and M. J. McMartin. Space 229.

E. D. E. Co., Chicago, Ill.—Anti-creeper tie plate with lock device, refrigerator and passenger car ventilator made in both steel and wood. Represented by Frank M. Gilmore and Frank J. Burns. Space 290.

Eastern Granite Roofing Company, New York, N. Y.—Granite roofing, "Evertite" roofing, "Tisbest" roofing, Palmoid roofing. Represented by H. Henning, C. F. Barstow and W. F. Sachs. Space 128.

Economy Separable Switch Point Company, Louisville, Ky.—"Economy" separable switch point, "Economy" adjustable

head rod, "Economy" foot guard, "Economy" separable claw bar, positive rail anchor and Betts combination rail anchor and tie plate. Represented by W. M. Mitchell, W. M. Mitchell, Jr., J. C. Haswell, R. H. Johnson and George A. Johnson, also J. F. Newhouse. Spaces 187-188.

Edison, Inc., Thomas A., Orange, N. J., and Chicago, Ill.—Edison "B. S. Co." primary batteries and accessories and Edison dictating and transcribing phonographs. Represented by E. E. Hudson, E. W. Brown, P. A. Garrity and F. J. Lepreau. Space 54.

Edison Storage Battery Company, Orange, N. J.—Edison storage battery. Represented by H. G. Thompson. Space 55.

Electric Railway Signal Company, Boston, Mass. — The Chapman automatic signals for electric railways. Represented by Charles N. Wood. Space 5.

Electric Storage Battery Company, Philadelphia, Pa.—Chloride accumulator batteries for bridge operation, car lighting and signal interlocking plants, "Exide" batteries for automatic block signal work and storage battery cars, storage batteries for railway work. Represented by Godfrey H. Atkin, Taliaferro Milton, H. M. Beck, R. I. Baird, P. G. Downton and T. A. Cressey. Space 23.

Enright-Frey Railway Equipment Company, New Orleans, La.—Enright boltless rail joint, tie plate and anchor combined; rail anchor, guard rail brace, self-grinding gauge cock. Represented by J. W. Enright and C. V. Frey. Space 163.

Fairbanks, Morse & Company, Chicago, Ill.—Nine h. p. generating outfit, 10 h. p. oil engine and pump, electric turntable tractor, telescopic standpipe, chain hoists, rail drills, jacks, motor cars, scales, cattle guards. Represented by A. A. Taylor, L. H. Matthews, E. M. Fisher, D. K. Lee, C. T. Fugitt, D. J. Higgins, L. Norvell, H. D. Smith, S. F. Forbes, H. E. Vergosen, W. K. Conard, C. W. Kelly, F M. Condit, J. L. Jones, W. W. Adams, Geo. J. Akers, F. H. Douglass, E. E. Pendray, F. V. Roy, Robert Elder and J. T. Gratiot. Spaces 73-74-75-76-92-93-94-95.

Fairmont Machine Company, Fairmont, Minn.—Handcar equipped with gasoline engine; one engine and equipment for handcar. Represented by F. E. Wade and H. E. Woolery. Space 156.

Federal Cement Tile Company, Chicago, Ill.—Roofing tile: special tile used on the Kansas City Union Station. Represented by I. H. Freund, LeRoy Baumgardtl, L. H. Tobey and Cheri Freund. Space 16.

Federal Signal Company, Albany, N. Y.—Interlocking and signal apparatus. Represented by John T. Cade, H. E. Thompson, C. Hurze, W. H. Richard, H. C. Ware and J. J. Hubbard. Space 38-39.

Franklin Manufacturing Company of Pennsylvania, Franklin, Pa.—Asbestos lumber smoke jacks, asbestos shingles, asbestos corrugated roofing and siding, asbestos and 85 per cent magnesia locomotive and stationary boiler lagging and steam pipe boiler coverings, journal box packings. Represented by R. J. Evans, H. S. Hayden, E. R Rayburn, L. B. Melville and F. S. McNamara. Space 6.

Frank M. Foster, Columbus, O.—Foster interlocking switch stands. Represented by Frank M. Foster. Space 138.

Fruit Growers' Refrigerator & Power Co., Anna, Ill.—Reinforced concrete railroad culvert. Represented by A. Christ, Jr., W. H. Leland and D. A. Faut. Space 204.

Galena Signal Oil Company, Franklin, Pa.—Perfection signal oil, Galena railway safety oil, ("B") Galena long-time burner oil. Represented by John W. Bunn and J. J. Bunn. Space 108.

John Gearon, Sr., Chicago, Ill.—Composite steel railway tie. Represented by Edward Gearon, John Gearon, Jr., M. V. Gearon, J. J. Gearon and F. F. Gearon. Space 198.

General Electric Company, Schenectady, N. Y.—Gasoline electric generating sets, steam air and water flow meters, portable air compressors, mercury arc rectifiers, motor generator sets, motors, transformers, lightning arresters, meters, switches, relays, rheostats and control panels. Represented by A. W. Jones, H. K. Ferguson, Frank Rhea, H. M. Jacobs, R. A. Lewis, L. W. Shugg, R. E. Woolley, W. O. Kellogg, J. W. Johnson, F. N. Boyer, W. H. Colman, O. E. Turner, L. A. Crawford, A. P. Jenks, C. A. Ives, C. H. Jones, A. I. Totten and H. L. Monroe. Spaces 35-36-37.

General Railway Signal Company, Rochester, N. Y.—Electric-dynamic interlocking system, electric interlocker, model 4 switch machine, high semaphore signal, dwarf semaphore signal and electric interlocking accessories, mechanical interlocking and accessories, direct and alternating current block signal apparatus, line and track relays, switch and tower indicators, transformers, reactances, etc. Represented by W. W. Salmon, G. D. Morgan, M. Wuerpel, Jr., W. K. Howe, F. L. Dodgson, H. M. Sperry, F. W. Moffett, L. Thomas, C. O. Poor, W. R. Young, M. R. Briney, W. S. Henry, A. Thomson, S. N. Wight, R. C. Leake, W. S. Workman and A. C. Holden. Spaces 56-57-58-59.

Greenlee Bros. & Company, Rockford, Ill.—Gasoline screw spike driving machine, hand-screw spike driving tools, automatic tie adzing and boring machines; other small tools. Represented by J. A. Lounsbury and F. Beitel. Spaces 7-8.

Grip Nut Company, Chicago, Ill.—Grip nuts, "Monogram" ladder fastenings, combination wrenches. Represented by E. R. Hibbard, J. W. Hibbard, W. E. Sharp, W. G. Willcoxson, Ed. Wilhelm, DeF. Lillis, Ben. Klein, Thos. P. Swan and C. Beaumont. Space 49.

Hall Signal Company, New York, N. Y.—Automatic signal appliances. Represented by W. J. Gillingham, Jr., and W. H. Lane. Spaces 77-78-79-80.

Hart Steel Company, Elyria, O.—Tie plates. Represented by W. S. Miller, W. T. Bentz, G. S. Wood and A. W. DeRocher. Space 101.

Handlan-Buck Manufacturing Company, St. Louis, Mo.—Signal lamps, lanterns, semaphore lamps. Represented by A. H. Handlan, Jr., and R. L. Cairncross. Space 126.

Hayes Track Appliance Company, Richmond, Ind.—Hayes derails, models A, C, CX and E, with operating and target stands. Represented by S. W. Hayes, W. Harding Davis, E. L. Ruby, E. C. Knapp, S. W. Wallace, Wellington B. Lee, Arthur Gemunder and F. C. Stowell. Space 140.

Hobart-Allfree Company, Chicago, Ill. — Smyth derailers, Freeland derailers, Newton car replacers and Newton divided car replacers. Represented by E. H. Allfree and W. H. England. Space 107.

Hoeschen Manufacturing Company, Omaha, Neb.—Batteryless system of highway crossing bells, magneto-mechanical generators for crossing bells, annunciators and signal devices. Represented by H. A. Holdrege, H. A. Hoeschen and H. P. Ryner. Space 168.

Hubbard & Co., Pittsburgh, Pa.—Railway track tools, track shovels and locomotive scoops. Represented by R. L. Mason, John J. Brooks and James A. MacLarghlin. Space 294, Armory.

C. W. Hunt Co., West New Brighton, N. Y.—Moving pictures showing coal handling machinery, working model of an automatic railway, narrow gauge car for carrying locomotive axles and wheels, full sized section of industrial railway track, models of coal valves and coal conveyors. Represented by C. T. Anderson and J. P. Maxwell. Spaces 209-210.

Indianapolis Switch & Frog Co., Springfield, O.—Frogs, crossings, switches and general track work, R-N-R frogs and crossings, model and full size working designs; "Eymon" continuous crossing, unit drilled special work of all types. Represented by E. C. Price, W. H. Thomas, O. E. Minnick, T. L. Hanley, W. B. Zittle, A. Murray, W. L. Walker, E. R. Burke, R. A. Boyd, G. S. Shaw, J. H. Eymon and W. E. Harkness. Spaces 228-237, Armory.

Ingalls-Shepard Forging Company, Chicago, Ill.—Standard mechanical interlocking parts. Represented by W. E. Foster and W. A. Stone. Space 3.

Inland Steel Company, Chicago, Ill.—Track bolts, spikes, rivets, concrete reinforcing bars, "Vismera" sheets. Represented by H. L. Hart, A. C. Roeth, R. C. Coombs. Space 225, Armory.

Interlocking Nut & Bolt Company, Pittsburgh, Pa.—Clark nut lock. Represented by R. A. Clark. Space 185.

International Automatic Signal Company, Chicago, Ill.—Electric cab signal with automatic stop. Represented by C. B. Teller, C. H. Corson, Yorke Burgess, H. Anderson, F. J. Brown and J. W. Clark. Spaces 201-212.

International Harvester Company, Chicago, Ill.—Oil and gas engines, pumping outfits, pumps. Represented by A. F. Young, C. C. Mangrum, F. W. Heiskell, F. S. Davis, W. D. Zarley and E. N. Wood. Spaces 189-190-191.

International Steel Tie Company, Cleveland, Ohio.—Composit railroad twin cross ties for light and heavy traffic. Represented by V. A. Oswald, J. J. O'Donnell, W. P. Day, George Harpham. Spaces 195-196.

Jerome Metallic Packing Company, Chicago, Ill.—Jerome metallic packing, Ruby portable steel houses, Stickley track sander. Represented by Geo. C. Jerome, Wm. H. Wilkinson. Spaces 161-162.

Johns-Manville Company, H. W., New York, N. Y.—"Transite" asbestos wood smoke jacks and ventilators, asbestos built-up and prepared roofing, wool felt roofing, corrugated asbestos roofing, "Transite" asbestos shingles, roof coatings, asbestos pipe coverings, packings, electrical materials, "J-M" sectional conduit, "J-M" fiber conduit for electrical wiring, and other building materials. Represented by J. E. Meek, J. C. Younglove, W. R. Jones, F. W. Doty, C. D. Folsom, C. W. Gearhart, H. A. Waldron, H. R. Wardell, W. H. Lawrence, H. B. Sewell, F. J. Horne, L. E. Hassman, E. A. Hurlbut, R. A. Hamaker, W. J. Hennessey, P. C. Jacobs, J. H. Trent,

D. L. Jennings, H. L. Leach, H. T. Morris, C. E. Murphy, H. M. Newell and H. G. Newman. Spaces 91-110.

Joyce Cridland Company, Dayton, O.—Railway jacks. Represented by Geo. W. Llewellyn, Frank S. Joyce, N. Irving Clock and Chas. D. Derby. Space 28.

Jordan Company, O. F., Chicago, Ill.—Jordan spreader. Represented by M. J. Woodhull. Space 14.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.—Hand, push and velocipede cars, track drills, track jacks, gauges, levels, wheels of various sizes, both all steel and wood center wheels, also motor cars. Represented by J. McKinnon, D. A. Stewart, C. A. Wallace, W. N. Sidnam, Wm. Winterly, W. D. Waugh, F. E. McAllister and L. L. Okey. Spaces 24-25.

Kellogg Switchboard & Supply Company, Chicago, Ill.—Railway telephone apparatus. Represented by Archibald Wray and W. P. Booith. Space 211.

Kennicott Company, Chicago, Ill.—Model of water softener, model of water weigher. Represented by Herman Nieter, F. S. Dunham, T. G. Windes, G. E. Pratt and W. D. Hawkins. Space 32.

Kerite Insulated Wire & Cable Company, New York, N. Y., and Chicago, Ill.—Kerite insulated wires and cables. Represented by R. D. Brixey, Azel Ames, P. W. Miller, J. A. Renton, J. W. Young, New York; B. L. Winchell, Jr., and G. A. Graber. Spaces 60-61-62.

Kernchen Company, Chicago, Ill.—Ventilating apparatus for cars and buildings. Represented by A. F. Roth, K. D. Heitt, F. J. Guignon and J. A. Gilmore. Space 105.

Keuffel & Esser Company, New York, N. Y.—Engineering instruments of all kinds, slide rules, drafting room supplies, etc. Represented by Rudolph Link, H. B. Huster and J. N. Gastfield. Space 51.

Lackawanna Steel Company, Buffalo, N. Y.—Structural material, rails, rail joints, rail joint plates, track construction, tie plates, steel sheet piling. Represented by Arthur P. Van Schaick, C. H. Hobbs, J. L. Hench, F. E. Abbott, A. H. Weston, John Chandler and C. R. Robinson. Spaces 277-278-279, Armory.

Lebanon Engineering Company, Lebanon, Pa.—Forged steel rail brace tie plates for steam and electric railways, head support washers for screw spikes, collet lock washers for track bolts. Represented by Francis T. West. Space 109.

Lehon Company, The, Chicago, Ill.—Roofrite roofing, Roofrite fabric-back roofing, plastic car roofing; waterproof canvas for passenger coach, cab and caboose roofing; Mulehide roofing and Mulehide car roofing, Per-Bona insulating paper, Dry-art insulating paper, Polar Bear insulating paper, Niagara weatherproof sheathing, Texproof brattice cloth and fireproof cloth, Staylastic and Damptite paint, etc. Represented by Tom Lehon, C. H. Fresher and D. B. Wright. Space 144.

Lidgerwood Manufacturing Company, New York, N. Y., and Chicago, Ill.—Excavator engine, excavator swinging engine, boom swinging engine. Represented by Frank B. Knight, E. C. Reeder, W. G. Wilmot, G. N. Crawford, Sr., G. N. Crawford, Jr., and W. R. Elden. Space 206.

Lorain Steel Company, Johnstown, Pa.—Track material, frog, crossing and switches of hardened center and solid manganese types; guard rail, clamps, switch throws, etc. Represented by W. W. Kingston, H. C. Evans, A. L. Verner, Carroll Burton, George Reese, H. C. Stiff, Wm. Lynam, A. S. Littlefield, C. G. Donnell and S. P. McGough. Spaces 247-250.

Lufkin Rule Company, Saginaw, Mich.—Tapes and rules of all descriptions. Represented by S. B. McGee and E. M. Eadie, Jr. Space 121.

Luitwieler Pumping Engine Company, Rochester, N. Y.—Non-pulsating pumps, water supply apparatus, electric and gasoline pumping apparatus, deep-well electric and gasoline pumping apparatus. Represented by Frederick D. Rich and S. W. Luitwieler. Space 183.

Lupton's Sons Company, David, Philadelphia, Pa.—Lupton steel sash for side walls, Pond continuous sash for monitor and sawtooth roofs, Pond operating device, special designs for lighting and ventilation of power houses and shop buildings. Represented by Clarke P. Pond and R. A. Sanborn. Space 50.

Lutz-Lockwood Manufacturing Company, The, Aldene, Union County, N. J. (P. O., Roselle, N. J.)—Gordon primary cells, "SX" ignition dry cells, Aldene dry cells. Represented by George Marloff, W. M. Kinch and G. A. Nelson. Space 175.

Walter Macleod & Co., Cincinnati, O.—Carbide lights, patent rail, patent spike. Represented by Oscar P. Gwinner and Walter Macleod. Space 164.

Massey Company, C. F., Chicago, Ill.—Concrete oil-house; visual and audible highway crossing signal, concrete battery wells, concrete cable posts, mile posts, marker posts, lamp posts, battery chutes, junction boxes, trunking, curbing, concrete pipe, telephone booths and watchmen's houses. Represented by C. F. Massey and E. M. Hatheway. Space 1,5.

McCord & Co., Chicago.—Locomotive mechanical lubricator for valve cylinders and driving boxes in operation, McCord pinless lid journal box. Represented by W. J. Schlacks, R. L. McIntosh, W. C. Reed and H. E. Creer. Space 288.

McFarlane Manufacturing Company, St. Paul, Minn.—Quick weight indicator to be used on scales. Represented by Robert McFarlane and F. E. Kaeppel. Space 69.

McGraw Publishing Company, New York, N. Y.—Weekly editions of Electric Railway Journal, Engineering Record and Electrical World. Represented by Hugh M. Wilson, J. A. Kucera, L. E. Gould, E. J. Hunt, E. M. Haas, F. J. Phelps, L. S. Louer, W. W. DeBerard, C. L. Williams, W. E. Keily, H. L. Fishacher and S. F. Cicero. Space 29.

McKinnis Switch Lock Company, Chicago, Ill.—Switch point lock. Represented by Victor Kohn, C. E. Rosenfels. Space 182.

Alexander Milburn Company, Baltimore, Md.—Portable acetylene construction, wrecking inspection and emergency lights, steam acetylene generators for locomotive headlight, wreckers and hoisting cranes. Represented by Charles R. Pollard, A. Frederick Jenkins and J. Schligher. Space 171.

Merden Frog and Crossing Works, Chicago, Ill.—Frogs, switches, switch stands, crossings, guard rails, guard-rail clamps, rail braces, etc., solid and built-up manganese steel work. Represented by Irving T. Hartz, Arthur C. Smith, Harry M. Mache, Dennis H. Cusic, William J. Mirden, Joseph F. Karcher and W. Homer Hartz. Spaces 238-239-240 Armory.

Modjeski & Angier, Chicago, Ill.—Laboratory equipment for complete chemical analysis and physical tests of cement and concrete. Represented by T. O. Brosted, H. N. Hirlihy, J. Dunraven Young, C. A. Bergendahl, A. W. Peters, Byron J. Carter, A. T. Holmgren and J. C. Reeves. Space 291, Armory.

Moore & Sons Corporation, Samuel L., Elizabeth, N. J.—Two pumping units consisting of Crescent fuel oil engines direct connected to pumps, one combined Crescent fuel oil engine and air compressor. Represented by William H. Yetman. Space 65.

Burton W. Mudge & Co., Chicago, Ill.—Mudge-Adams motor car. Represented by Burton W. Mudge, Herbert Green, Thos. H. Garland, Robert D. Sinclair, George W. Bender and W. E. Adams. Spaces 71-72.

Nachod Signal Company, Philadelphia, Pa.—Track plan connected with operative signals, high speed trolley contactors, miscellaneous signal parts. Represented by Carl P. Nachod and Frederick W. Kulicke. Space 2.

National Carbon Company, Cleveland, O.—Columbia track batteries, dry batteries, multiple batteries. Represented by E. L. Marshall, Chas. S. Pflasterer and M. H. Moffett. Space 179.

National Lock Washer Company, Chicago, Ill., and Newark, N. J.—Nut locks and methods of testing. Represented by F. B. Archibald, R. L. Brown, H. J. McGinn and John B. Seymour. Space 125.

National Malleable Castings Company, Chicago, Ill., and Toledo, O.—Track appliances. Represented by H. I. Hiatt, Thos. Blogden, J. J. Byers, Claude Johnston and J. W. Stephenson. Space 104.

National Surface Guard Company, Chicago, Ill.—Metal surface stock guards, steel grain doors, ratchet track wrenches. Represented by I. L. Bolinger, J. T. Hall and C. H. Luthman. Space 176.

Geo. P. Nichols & Bro., Chicago, Ill.—Electric turntable tractor. Represented by Geo. P. Nichols, S. F. Nichols, Henry Fries and Nicholas Fries. Space 173.

Northwestern Construction Company, New York—Banks' signal cells (R. S. A.), Banks' track circuit cells, N-W binding post. Represented by W. C. Banks and R. C. Wood. Space 4.

Northwestern Manufacturing Company, Milwaukee, Wis.—Motor generator sets, motors for operating semaphores and switches, general line of motors and dynamos. Represented by Wm. Stark Smith, Frederick W. Ells and Walter J. Aitken. Space 4.

Ogle Construction Company, Chicago, Ill.—Coal chute, bucket hoisting machine. Represented by R. A. Ogle and C. F. Bledsoe. Space 220.

Okonite Company, New York, N. Y.—"Okonite" insulated wires and cables of all styles and sizes for electrical service, "Okonite" and "Manson" tapes for insulating joints in electrical conductors, etc. Represented by J. D. Underhill, W. G. Hovey, J. M. Lorenz and R. N. Baker. Space 18.

Spencer Otis Company, Chicago, Ill.—Economy tie plates, "Au-Tra-Kars," American "Kron" dial scales. Represented by W. L. DeRemer, Carter Blatchford, H. H. Hart, T. W.

Blatchford, O. M. Olson, Hunter Michaels, A. L. Hammond, C. E. Latta, W. D. Thompson, L. D. Rockwell, A. S. Flowers, A. J. Odegaard, George Ringshausen, Charles Bank, George H. Goodell, J. L. Connors, C. H. Wilson and Clive Hastings. Spaces 122-141-142-143; Armory, 226-227.

P. & M. Company, Chicago, Ill.—P. & M. rail anti-creeper, Crane guard rail retainer, bond wire protector. Represented by D. T. Hallberg, R. D. Hawley, J. H. Hubbell, G. E. Johnson, L. W. Kent, R. J. Mercur, Philip W. Moore, F. A. Preston, J. Ritchie, A. R. Sutter and F. C. Webb. Space 123.

Patterson Company, W. W., Pittsburgh, Pa.—Hand-made tackle blocks, wood or steel, for manila rope or wire cable. Represented by W. W. Patterson, Jr. Space 147.

Payson Manufacturing Company, Chicago, Ill.—Mechanical devices for operating sash in series; ball bearing steel wheels, railway velocipedes. Represented by W. E. Peters, E. T. Harris and F. E. McClimans. Space 222.

Pease Company, C. F., Chicago, Ill.—Automatic blue print machines, washing and drying machines and trimming tables, blue print paper coating machines. Represented by C. F. Pease, P. M. Morgan, Thomas Lord, T. K. Murney and H. E. Thompson. Spaces 157-158.

Peerless Wire Fence Company, Adrian, Mich.—Galvanized self-raising gate. Represented by W. H. Burnham and W. Niblack. Space 292, Armory.

Pennsylvania Steel Company-Maryland Steel Company, Philadelphia, Pa.—Crossings, frogs, switches, knuckle rails, switch stands, rails and joints. Represented by G. S. Vickery, W. M. Henderson, C. A. Langdon, G. W. Parsons, C. A. Alden, W. H. Allen, R. E. Belknap, D. Allen, J. F. Hennessey and George K. Reel. Spaces 241-242-243-244-253-254-255-256, Armory.

Pittsburgh Steel Company, Pittsburgh, Pa.—Railroad fencing; barbed wire, plain wire; wire nails, etc. Represented by M. E. Johnson, E. Sidney Lewis, Geo. A. Dickson and E. D. Findlay. Spaces 284-285.

Pocket List of Railroad Officials, New York, N. Y., and Chicago Ill.—Pocket lists. Represented by J. Alexander Brown, Charles L. Dinsmore and Harold A. Brown. Space 26.

Potter Winslow Company, Chicago, Ill.—Battery vaults and other railway supplies in concrete. Represented by G. H. Macdonough, A. C. Heidelberg and G. H. Davis, Jr. Space 174.

Q. and C. Company, New York, N. Y., and Chicago, Ill.—Bonzano joints, step joints, anti-creepers, guard rail clamps, rail benders, rail saws, rail-laying machine. Represented by C. F. Quincy, F. F. Kister, G. L. Hall, T. B. Bowman, J. J. Quinn, J. A. Bodkin, A. E. Stokes, A. R. Horn, E. M. Smith and J. V. Wescott. Spaces 120-139.

Rabok Manufacturing Company, St. Louis, Mo.—"Rabok" preservative paints. Represented by D. C. Wray and J. Y. Martyn. Space 160.

Railroad Supply Company, Chicago, Ill.—Tie plates, derailers, highway crossing bells and electric railway signal appliances. Represented by E. H. Bell, C. P. Cogswell, Jr., E. W. Vogel, M. J. Comerford and A. H. Smith. Space 85.

Railway and Supplymen's Mutual Catalog Company, Chicago, Ill.—The Railway and Supplymen's Mutual Catalog, exhibition of Hollerith sorting and tabulating machines. Represented by Albert MacRae, F. R. Goehler and Clarence H. Struble. Space 181.

Railway List Company, Chicago, Ill.—Monthly publications: Railway Engineering and Maintenance of Way, Monthly Official Railway List. Represented by W. E. Magraw, C. S. Myers, L. F. Wilson, W. R. Toppan, K. L. Van Auken and C. C. Zimmerman. Space 136.

Ramapo Iron Works, Hillburn, N. Y.—Automatic safety switch stands, rolled steel shoulder switch slides, guard rail clamps, manganese reinforced switches and frogs. Represented by J. Edgar Davidson, Arthur Gemunder, W. C. Kidd, Wellington B. Lee, William Wait Snow and James B. Strong. Spaces 280-281-282, Armory.

Roadmasters and Maintenance of Way Association, Sterling, Ill.—Literature. Represented by L. C. Ryan, Harry Clark and W. A. Kannally. Space 224.

Roberts & Schaefer Company, Chicago, Ill.—Photographs of installation of Holmen balanced bucket coaling stations and Sauerman coaling stations with working models. Represented by Warren R. Roberts, E. E. Barrett, Clyde P. Ross, E. P. Stewart and James S. Shannon. Spaces 97-98.

Rail Joint Company, New York, N. Y.—Continuous, Weber and Wolhaupter rail joints. Represented by L. F. Braine, P. Holbrook, V. C. Armstrong, W. E. Clark, F. A. Poor, F. C. Webb, E. A. Condit, E. L. Van Dresar, H. C. Holloway, G. C. Isbester, R. W. Smith, F. M. Hill and W. S. Boyce. Spaces 81-82.

Railway Age Gazette (Maintenance of Way Daily) and The Signal Engineer and American Engineer, New York, N. Y., and Chicago, Ill.—Represented by Edward A. Simmons, Samuel O. Dunn, Lucius B. Sherman, Henry Lee, John N. Reynolds, Frank S. Dinsmore, Cecil R. Mills, Arthur E. Hooven, Bradford Boardman, E. T. Howson, William Forsyth, W. E. Hooper, A. D. Cloud, H. H. Simmons, Harold F. Lane, F. H. Thompson, W. D. Horton, Kenneth G. Cloud, Harold D. Horton and T. E. Crossman. Space 44.

Rich Tool Co., Chicago, Ill.—High power drill press, high speed twist drills, reamers, rivet sets, track bits, flue expanders, beading tools. Represented by George R. Rich, W. L. Anderson, Paul Harders and Oscar F. Shubert.. Space 205.

Sandwich Electric Company, Sandwich, Ill.—Selective train despatching apparatus, selective order boards, cordless jack boxes, cordless test panels. Represented by E. C. Hennis, M. E. Launbranch, J. G. Moore, H. O. Rugh and C. S. Rhoads. Space 202.

Scherzer Rolling Lift Bridge Company, Chicago, Ill.—Models, literature, photographs, plans, etc., of Scherzer rolling lift bridges. Represented by Albert H. Scherzer, Fayette F. Soule, C. L. Keller, John T. Dickerson and James I. Vincent. Space 178.

Sellers Manufacturing Company, Chicago, Ill.—Sellers anchor bottom tie plate. Represented by John M. Sellers, Joseph T. Markham, Leslie S. Gordon and Rex S. Gay. Space 124.

Shane Steel Railway Tie & Appliance Co., Denver, Colo.—Shane steel, railway tie and fastening. Represented by R. H. Dwyer and G. F. Kiser. Space 223.

Signal Accessories Company, New York, N. Y—Signal and track devices. Represented by F. C. Lavarack and W. F. Bossert. Space 118.

Signal Engineer, The, New York and Chicago.—See Railway Age Gazette. Space 63.

Jesse R. Smith, Benton, Ill.—Railway tie pullers. Represented by W. W. Whittington. Space 135.

Snow Construction Company, T. W., Chicago, Ill.—Coal chutes, standpipes, engines, pumps. Represented by T. W. Snow, R. E. Gurley and Marshall Miller. Spaces 45-46.

Standard Asphalt & Rubber Company, Chicago, Ill.—"Sarco" waterproofing and asphalt floor materials. Represented by Norman Malcolm, Charles V. Eades, Robert F. Trumbull and R. E. Kartack. Space 1.

Standard Underground Cable Company, Pittsburgh, Pa.—Various forms of wires and cables for all electrical purposes, junction boxes and terminals. Represented by J. R. Wiley and Russell E. Green. Space 152.

Stark Rolling Mill Company, Canton, O.—Black and galvanized "toncan" metal sheets and formed products. Represented by A. T. Enlow, J. T. Hay and F. E. Newell. Space 194.

Stotts Signal Company, Marion, Iowa—Automatic signal. Represented by A. W. Caul, J. I. James, W. A. Weaver and J. F. Sparks.

Strait Scale Company, Kansas City, Mo.—Registering beam scale 200,000 pounds capacity. Space 180.

Strauss Bascule Bridge Company, Chicago, Ill.—Models of Strauss trunnion bascule bridges and Strauss direct lift bridge. Represented by J. B. Strauss, Gunni Jeppesen, J. R. Hall, Phil L. Kaufman and A. F. Bruss. Space 159.

Templeton, Kenly & Co., Ltd., Chicago, Ill.—Simplex car and track jacks. Represented by Alfred E. Barron, J. H. Hummel, Arthur C. Lewis and W. B. Templeton. Spaces 15-33-34.

The Railway and Engineering Review, Chicago, Ill.—Publications. Represented by Willard A. Smith, W. M. Camp, Clyde F. Barus, John M. Lammedee, J. E. Sample, R. R. Greig, Harold A. Smith, Parker G. Stevens, Drusus H. Nichols, F. C. Barton. Spaces 64 Coliseum and 283 Armory.

The National Roofing Company, Tonawanda, N. Y.—Security wide-weld gravel surface roofing. Represented by D. A. Bonitz, P. E. Sinnett, C. L. Cockrell and S. E. Baldwin. Space 170.

Trussed Concrete Steel Company, Detroit, Mich.—Kahn building products, reinforcing steel, Kahn trussed bars, rib bars, rib metal "Hy-Rib," column hooping, "Hy-Rib" and rib lath for roofs, sidings, partitions and ceilings, United steel sash for windows, side walls and monitors, United steel partitions and United steel doors. Represented by H. J. Stambaugh, E. G. Roberts and V. L. Page. Space 27.

Tweedy, Hood & Finlen, Inc., Chicago, Ill.—Shovels, belting, rubber pump valves, locomotive stack netting, brass and steel wire cloth. Represented by R. E. Derly and S. C. Frerich. Space 153.

Union Switch & Signal Co., Swissvale, Pa.—Sales department. Interlocking and signaling apparatus. Represented by Col. H. G. Prout, J. G. Schreuder, S. G. Johnson, J. A.

Hobson, G. A. Blackmore, H. W. Griffin, H. A. Wallace, T. H. Patenall, Aaron Dean, W. M. Vandersluis, J. L. Brastow, J. P. Coleman, L. F. Howard, M. D. Hanlon, W. H. Cadwallader and J. D. Taylor. Spaces 40-41-42-43.

United States Electric Company, New York, N. Y., and Chicago, Ill.—Gill selectors for railway telephone and telegraph, railway telephones and accessories, safety lanterns for railway trainmen, storage batteries. Represented by W. L. Cook, W. E. Harkness and H. E. Merrell or C. N. Sigison. Space 203.

United States Light & Heating Company, New York, N. Y.—All lines of pasted and Planté plates and cells. Several cells show sectional views: Cells for power, lighting, propulsion and ignition. Represented by W. P. Hawley, Bertram Smith, W. F. Bauer, J. E. Widner and Joseph Wren. Space 114.

U. S. Wind Engine and Pump Company, Batavia, Ill.—Mansfield and U. S. rigid, telescopic and adjustable spout water columns; fir, pine and cypress water tanks; flat, round and half-round hoops; Halladay outlet valves, tank fixtures, Curtis pumps, water station material, pumping windmills, switch stands and semaphores. Represented by L. E. Wolcott, C. E. Ward, J. P. Prindle, Jr., and G. E. Vermilyer. Space 111.

Universal Concrete Tie Company, New Orleans, La.—Reinforced concrete tie and rail-fastening device for steam and street railroads. Represented by M. W. Carrico and H. E. Percival. Space 150.

Universal Metallic Tie Company, Salt Lake City, Utah.—Metal railway tie. Represented by B. S. Rupp. Space 207.

Verona Tool Works, Pittsburg, Pa., and Chicago, Ill.—Track tools and nut locks. Represented by H. Fischer, W. H. Remmel, E. Woodings and Geo. Shapland. Space 148.

Vinan's Improved Patent Rail Joint Company.—Samples of rail joints. Space 185½.

Weir & Craig Manufacturing Company, Chicago, Ill.—Represented by Fred G. Whipple and R. W. Young. Space 30.

Weir Frog Company, Cincinnati, O.—Railroad switches, switch stands, guard rail clamps, frogs. Represented by N. O. Goldsmith and Charles E. Hogan. Spaces 286-287, Armory.

Western Electric Company, Chicago, Ill.—Telephone train despatching apparatus, Habirshaw wire, flaming arc lamps, W. E. interphones for railway shops, sunbeam train lighting lamps, miscellaneous supplies. Represented by G. H. Porter, J. F. Finley, E. W. Hamlin, E. V. Adams, F. A. Ketcham, L. A. Muttart and H. B. Hutchings. Space 197

Whall & Co., C. H., Boston, Mass.—Railway fiber and fuses. Represented by F. R. Whall and J. B. Given. Space 127.

Wm. Wharton, Jr., & Co., Inc., Philadelphia, Pa.—Switch points, guard rails with guard-rail clamps attached, manganese steel frogs, switch stands, manganese steel crossings, models, etc. Represented by V. Angerer, L. R. Ashhurst, Jr., W. B. Cooke, George B. Lyman, H. F. McDermott, R. C. McCloy, W. McLain and Arthur S. Partridge. Spaces 257-258-271-272, Armory.

Williams Company, The, G. H., Cleveland, Ohio—Clam shell dredging and excavating buckets, derricks, etc. Represented by G. H. Williams. Space 192.

Young Continuous Rail & Boltless Angle Bars Company, The J. D., Oklahoma City, Okla.—Boltless angle bar. Represented by J. D. Young, R. E. Brittain, L. A. Brittain and L. C. Adkisson.

A SECTIONAL CONCRETE PILE CASING.

Foundation and underpinning work for heavy buildings in the larger cities very frequently involves problems which severely tax the resources of the ablest engineers. Wood piles were formerly used and have been found satisfactory as long as covered with water, but owing to the constantly varying conditions this water is being drained from one point to another, allowing the piles to decay and the buildings to settle. Concrete in one form or another has proved an excellent material, but the methods of getting concrete properly into place have frequently been difficult of application. One of the methods of placing concrete which is meeting with much favor is with the use of a hollow steel pipe or casing. A steel pipe of any required diameter, corresponding to the size of an ordinary pile, and of any convenient length is driven directly with a driving head. This casing is made of ¼-in. to ⅜-in. steel, and when driven to place provides a hollow steel tube ready for concrete. A cast iron shoe is used for a point and is fitted with a hole for jetting if required. In some soils, such as sand, the pipe may be driven without a point and the sand removed through the pipe as the driving proceeds.

For underpinning where head room is limited, the sectional concrete pile casing is of great advantage. By adding additional sections, piles of any ultimate length can be built up in the process of driving. It is claimed that there are over 200,000 ft. of these piles supporting structures in New York City, and that a pile has been driven over 80 ft. without buckling or losing its alinement.

The following data are submitted by the manufacturers as tests of their product: A 12-in. pile, consisting of five sections, was jacked down in sand strata to bedrock a distance of 33 ft. and filled with concrete. It supported 135 tons dead weight without any deflection or change whatever and with a depression of but 1/32 of an inch. In another test, eight 7-ft. sections of a 9-in. casing to carry a live load were driven with a hammer until a resistance of 80 tons was shown. The column was tested with an electric bulb in the interior before filling with concrete and the alinement was found to be perfectly true. It is said that piles have been driven from 30 ft. to 85 ft. under the above conditions. This type of pile is made by the John Simmons Company, New York.

CAST-IRON GUTTERS.

The cast-iron gutters exhibited by Hitchings & Co., Elizabeth, N. J., are especially adapted to stations, train sheds, etc. These gutters are now being tried out on some of the stations of the Pennsylvania Railroad. They are said to be more durable than sheet metal or wood gutters and more easily erected. They are intended to replace the sheet-iron or copper, or tin or copper lined, hanging gutters. Cast-iron gutters are claimed to be stronger than other gutters and are less liable to injury through snow, ice and rust. Some cast-iron gutters which were installed 20 years ago, in other than railway service, are still in perfect repair and giving excellent service. These gutters require no soldering and are easily erected by any mechanic, being secured to the facia with ordinary wood screws. The half-round gutter is also supported by a bracket. It is claimed that it is not necessary to place these gutters on a grade, as any water that may remain standing in them does no harm.

SWITCH STANDS.

The new type of switch stand shown by The Pennsylvania Steel Company, Steelton, Pa., known as model 60-A, shows a drop forged crank, fitted to the squared end of the target spindle, to which crank the connecting rod is attached. The hub of the segment gear, which is acuated by the lever pinion, extends through the bottom of the stand and carries on its squared end a shear crank. Between this shear crank and the rod crank, connection is established by a cast iron shear pin resting in a pocket between the two cranks. When the stand is run through with its lever locked, the cast iron pin is sheared off, releasing connection between the target spindle and the gears; the switch points are thrown, carrying with them the target which is still attached to the points by means of the connecting rod and crank.

With this stand is furnished the company's new adjustable connecting rod which gives the stand the advantages of switch adjustment found in the adjustable New Century

switch stand, model 51. This is a departure in adjustable rods, inasmuch as it is adjustable not only as to the length of the rod, but it also enables each switch point to be adjusted in relation to the stock rail, independently of the other point, without disconnecting the rod.

This connecting rod does away with all types of expensive switch bar adjustment, and all other forms of high priced adjustable switches. It may be applied to any switch or stand already installed by increasing the throwing capacity of the stand and by adapting it to the stand connection. For facility and quickness in stand installation, this connecting rod is most advantageous.

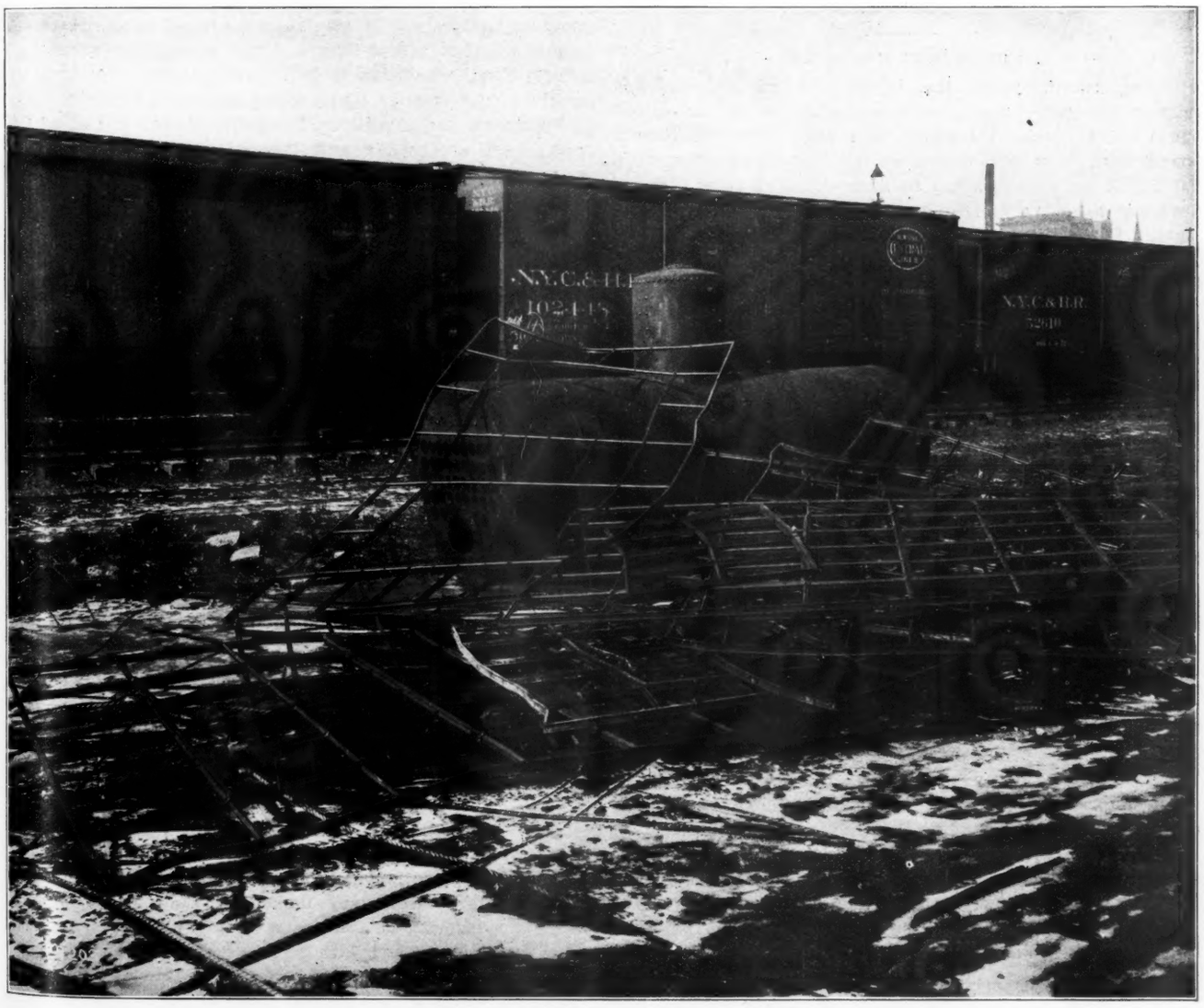
SCHERZER ROLLING LIFT BRIDGES.

The recent business of the Scherzer Rolling Lift Bridge Company, Chicago, includes a number of notable foreign orders, among which is one for a double track combined railway and highway bridge for the Great Central Railway of England across the River Trent, having a movable span of 160 ft. and a width of 53 ft. 6 in. out to out. This bridge will be the widest and heaviest movable bridge yet constructed in Great Britain. Two Scherzer bridges have recently been completed for the Dublin Port & Docks Board, Dublin, Ireland, and a large railway and highway Scherzer bridge is nearing completion for the Swansea Harbor Trust at Swansea, Wales. The very large Scherzer rolling lift bridge under construction across the Nile River at Cairo, Egypt, is rapidly nearing completion and is expected to be in service within a few months. The Buenos Ayres Great Southern has recently placed under construction the fourth Scherzer bridge in the process of modernizing and extending its terminal facilities at Buenos Ayres. The South Indian railway, in the process of extending its line toward the Island of Ceylon, is constructing a double leaf Scherzer bridge having a movable span of 225 ft.

Within the United States and Canada more than one hundred and fifty Scherzer rolling lift bridges have been constructed and placed under construction. The more recent railway bridges placed under construction include a double track bridge for the Central Railroad of New Jersey, a double track bridge for the New York & Long Branch railway, and bridges for the Southern, Savannah; the Atlantic Coast Line, Navassa, N. C.; the Aransas Harbor Terminal Railway, the Wildwood & Delaware Bay Short Line, the Canadian Pacific at Fort William, Ont., the Canadian Northern across the Salmon River and another across Rideau Canal.

DETROIT FENESTRA WINDOWS IN THE PREST-O-LITE BUILDING COLLAPSE AT INDIANAPOLIS.

The Prest-O-Lite building, at Indianapolis, Ind., which has attracted considerable attention from builders and engineers during the past two months, owing to its sensational collapse after three stories had been erected, and in which ten men



Detroit Fenestra Windows, Taken From the Ruins of the Prest-O-Lite Building, Indianapolis.

lost their lives, has also been the means of drawing attention to several features of building construction, exposing their weaknesses or accenting their merits in a very effective way. One of the building materials, which, while not directly connected with the cause of the accident, was seriously involved in the effect of it and which came through the ordeal in excellent shape, was the steel windows supplied by the Detroit Steel Products Company, Detroit, Mich.

Strength or rigidity is necessarily a fundamental requirement of steel windows and incidentally one of the most difficult to retain in ordinary processes of manufacture. The ordinary steel window is built up of a number of small pieces, and any injury to it in shipping or erection permanently weakens the frame. Furthermore, considerable strength is required to enable the light steel frame to resist wind pressure or expansion in case of fire.

The manufacturers of Detroit fenestra windows, which were installed in the Prest-O-Lite building, claim that the patented "fenestra joint," by which their windows are distinguished, adds greatly to the strength or stability of the frame. It would appear that this test furnishes rather convincing evidence in support of the manufacturer's statement. As will be seen from the photograph reproduced herewith, the windows which came down with the walls as they collapsed, though badly distorted, have not in any case been broken or pulled apart.

NOTES ON WATERPROOFING DESIGN FOR BRIDGE FLOORS.

BY NORMAN MALCOLM.

During recent years the importance of waterproofing railway structures has become so much better understood and more generally attempted that at the present time a specification is seldom drawn up for new construction without requiring waterproofing in some form or other. Specifications have very frequently called for waterproofing, leaving the details to the contractor who may select the waterproofing on the basis of lowest cost, to the superintendent, or to a subordinate who, lacking information as to the best material or method, may be led to select something entirely inadequate.

Rapid progress is being made in effective waterproofing construction as applied to railway work, and to bridge floors in particular. Subway bridges offer great difficulties and great demands for satisfactory waterproofing.

In the absence of definite information regarding the best method and material to use, attempts have been made to secure results with literally hundreds of materials and schemes. Since ineffectual waterproofing is just the same as, or may be, worse than no waterproofing at all, large sums of money have been uselessly expended in these generally unsuccessful attempts and experiments, but it is encouraging to note that as a result of past experience it is now pretty well recognized that waterproofing a bridge floor or viaduct is not an easy matter to be readily accomplished by any material, but is a difficult problem, requiring for successful solution the use of the very best obtainable product which must be especially adapted to resist the action of water and other oxidizing agents, undergoing wide temperature extremes with slight change of form or character, and withstanding contraction and vibration of the structure without rupture either in the body of the waterproofing or at the edges, where an effective seal must be maintained to prevent the entrance of moisture.

Another encouraging feature of waterproofing work is the better understanding that drainage and waterproofing go hand in hand. To render the waterproofing engineer's problem more easy and certain of successful solution, the structural engineer must give due consideration to waterproofing and drainage requirements. Many structures have been so constructed as to be practically impossible to make waterproof. A slight change in design or easily provided modification during construction might have rendered the waterproofing a comparatively easy matter. It is in this connection that the waterproofing engineer finds his most frequent opportunity to render valuable service.

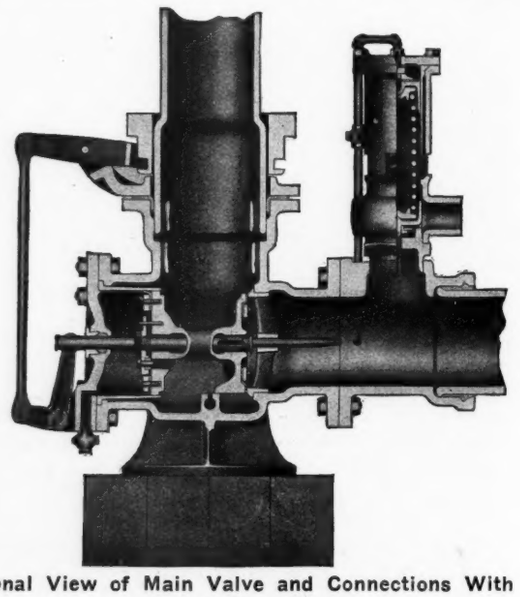
Supplementing the conclusion that the waterproofing problem is difficult, even for the best available material, is the growing conviction that success results from both quality and amount of waterproofing compound used rather than from the number of plies of fabric, felt or other material employed in the construction of the waterproofing membrane. There is a consequent tendency to reduce the number of layers. While 10-ply waterproofing used to be, and 5 or 6 ply still is, common enough, one of the most successful waterproofing companies now uses a standard specification of 3-ply, and is at the present time testing out a 2-ply membrane, but using the same amount of waterproofing compound as before and with very satisfactory results.

TELESCOPIC SPOUT STANDPIPE.

One of the most marked changes in railroading as observed by the general public is the difference between the size of the locomotive of to-day and of a few years ago.

The large locomotives, with their proportionately large tenders, which are in use at the present time, require a standpipe that will deliver a large amount of water in a short time, in addition to being suitable for watering locomotives with smaller tanks which are still in service.

To meet these conditions, Fairbanks, Morse & Co., of Chicago, have designed a new type of standpipe with a telescopic spout, styled the "No. 10 Telescopic Spout Standpipe." This spout has a vertical range of 5 ft., so that the highest



Sectional View of Main Valve and Connections With Automatic Relief Valve.

and lowest engine tender can be filled with no waste or dripping of water.

The main valve is water balanced, the water on both sides of it, when closed, being under the same pressure as in the main, insuring no leakage and minimum wear. The pipe is regularly furnished with an automatic relief valve which prevents "water hammer," so destructive to pipe lines and tanks. Operating rods are all on the outside, insuring easy adjustment and repair. The No. 10 is a one-man pipe and

does not require anyone on the ground to assist the fireman on the tender. It is securely locked parallel with the track and will automatically lock in this position when swung back from the tender. One of these standpipes is on exhibit at the Coliseum.

THE HALL STYLE "K" SIGNAL.

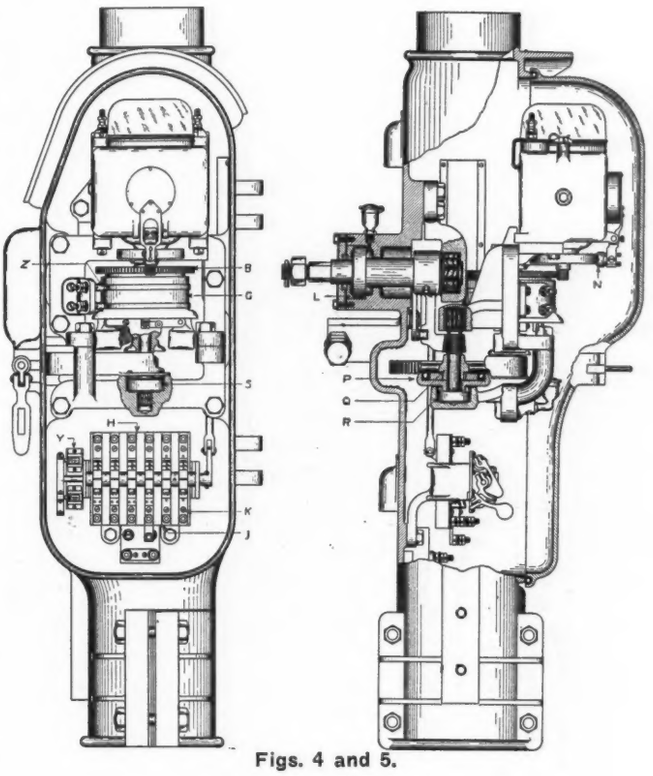
In the Hall Signal Company's style "K" automatic signal the retardation is effected by a pair of governors attached to the hold-clear armature, which rub against the insulated portion of the hold-clear magnet, and provide friction in proportion to speed. No dash pot of any description is used in this signal, no mechanical latches are used, and the motor armature does not reverse. There is no friction provided by these governors with the blade at rest in the clear or stop positions, and the governors are effective only when in returning to the stop position the speed of the blade reaches a predetermined rate.

The friction of these governors increases proportionally to the speed of the blade returning to danger, so that the control is entirely automatic, and the friction of the governors is effective only when required. One governor alone will retard the signal sufficiently to prevent damage.

The feature of signal design that is probably next in importance to the method of retardation is the construction of the bearings for the shafts and in the mechanism. All the bearings on the style "K" signal are either roller or ball bearings. The main shaft is supported on the blade end by an "S K F" ball bearing, and on the inside end by a "Hyatt" roller bearing. The "S K F" ball bearing is constructed of a double row of balls fitted in a brass cage, with steel supporting rims inside and outside. It is self-aligning, withstands a thrust strain of 25 per cent of its radial capacity, and is very accurately manufactured. It may be floated in oil, yet very little oil is actually required to keep it in good condition. Exhaustive tests made with this bearing in a blade shaft, extending throughout an entire winter, have shown that these bearings may be operated almost indefinitely without oil. The "S K F" bearing is also used at all points in the mechanism where a thrust and radial bearing is required, as at "L."

The Hyatt roller bearing has been used on the Hall style "H" mechanism for the past two years and has given perfect service. For the lesser requirements, where the shaft does not reverse, and where the strain is slight, a roller bearing made of steel rollers and supports is used. Protection to the bearings and provision for oiling has also been given proper attention. The ball bearing on the outer end of the blade shaft is protected by a weather plate, with a soft gasket between it and the main casting. A substantial oil cup is provided for the shaft bearing and accessible oil cups and pipes are provided for all important bearings in the mechanism. The essential bearings are also provided with space so as to allow the bearings to float in a continuous oil bath, which insures against rust.

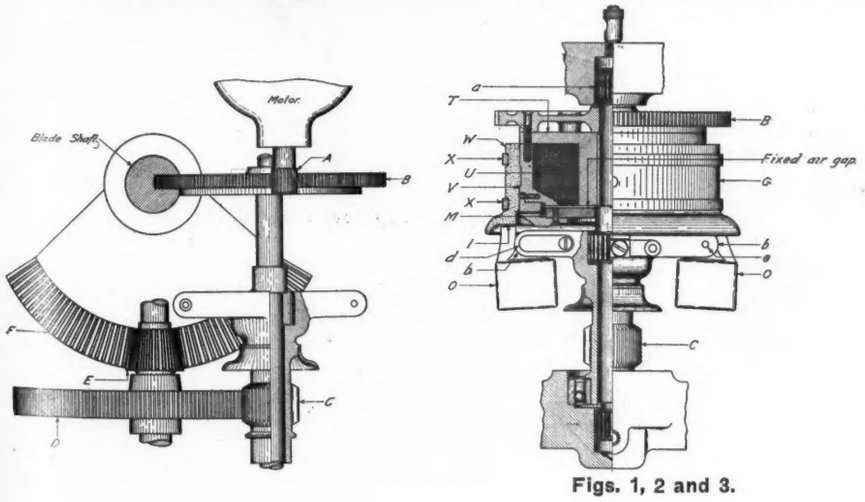
The hold-clear magnet on the style "K" signal is of the disc type similar to the design used in the Hall electric slot. In the latter device the armature is nickel plated to provide an air gap equivalent, but in the style "K" signal in addition to the plating of the armature, an actual air gap is provided. A phosphor bronze outer ring is fastened to and made a part of the Norway iron armature, and when the magnet is



Figs. 4 and 5.

energized, the bronze ring bears against a steel piece on the magnet, which provides the friction required to hold the signal clear. The torque of the blade and blade grip are very heavy on this armature, the frictional surface is small, and the armature is well protected.

Steel pinions and bronze gears are used. The gears and pinions are placed in such manner that the teeth are vertical, and the clearance between gear and pinion teeth is sufficient to prevent clogging by ordinary particles of dirt. Guards protect the gears from dust and foreign matter, yet



Figs. 1, 2 and 3.

all the gears may be plainly observed during the operation of the signal.

The motor used in the style "K" signal is of an improved design. The motor will operate an upper quadrant blade, R. S. A. design, with R. S. A. blade grip, with an ordinary 10-volt battery, through an arc of 90 deg., and using a maximum of 2½ amperes of current in eight seconds.

The operation of the style "K" signal is as follows: Motor pinion A, Fig. 1, is geared to the blade shaft through gears

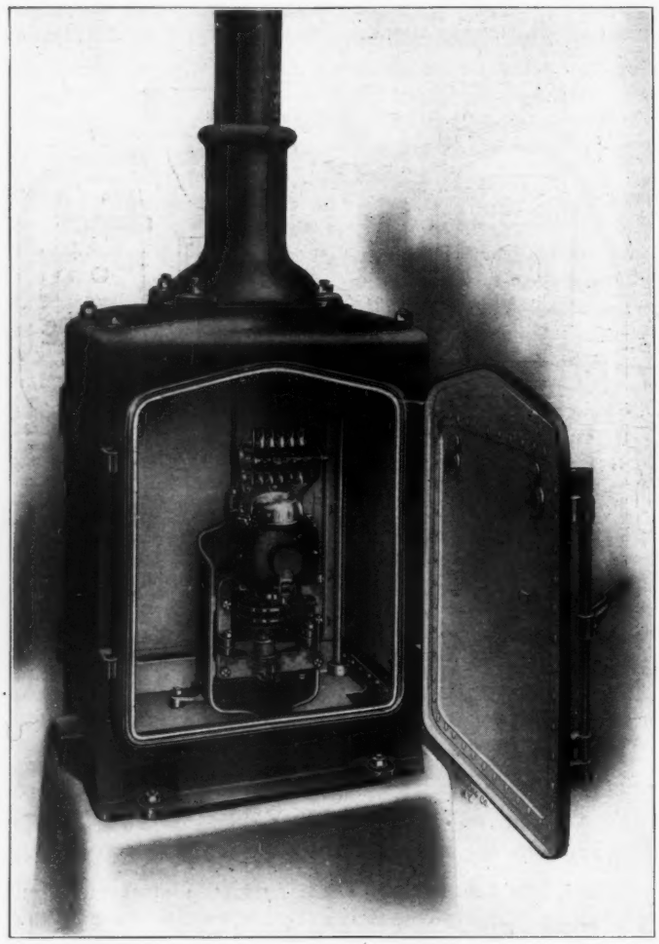


Fig. 6. Style K Mechanism, Bottom-Post Type.

and pinions, B, C, D, E and F. Gear wheel B, Fig. 2, is rigidly attached to hold-clear magnet G. The armature of the hold-clear magnet is supported on a separate shaft from the magnet and gear wheel B, and revolves independently of the magnet. When the current is applied to the motor and hold-clear magnet, the blade shaft is rotated by means of the gear connections in the usual manner. Contact J on circuit breaker H, Fig. 4, normally closed, is adjusted to open when the blade is in the 45-deg. position, and contact K, also normally closed, is adjusted to open when the blade reaches the 90-deg. position. A typical circuit plan of the mechanism wiring for three-position operation is shown in Fig. 3. The operation of clearing the blade and holding it at clear is dependent upon the energization of clutch magnet G, Fig. 2. After the blade is moved to the caution or clear position, it is held at rest by the friction of the outside bronze rim on the hold-clear armature M, Fig. 2, against the steel surface on magnet G, which friction is caused by the energization of the clutch magnet. The clear or caution position of the blade is also maintained by motor brake N, Fig. 5, which prevents the reversal of the motor armature. There are, accordingly, two requirements for holding the signal clear: the energization of the hold-clear magnet, and the application of the motor brake. When the circuit of the hold-clear magnet G is opened, as by a train in the block, the armature of this magnet is released, and the torque of the blade and its casting causes the blade shaft, gears and pinions F, E, D and C, Fig. 1, and hold-clear armature M, Fig. 2, to reverse and the signal to return to its normal position. The governors, O-O, Fig. 2, are attached to the hold-clear armature, and as the speed of the blade in its return to the stop position increases, the governors are thrown outwardly by centrifugal force, and the upper surfaces rub against the surface 1 of the insulated portion of the hold-clear magnet which remains stationary. The friction of the contact of these surfaces retards the movement of the blade; the amount of friction is dependent upon the weight of the governors and the speed of rotation of the armature. The governors are designed so that they regularly check the movement of the blade, and no adjustment is required.

A view of hold-clear magnet, armature and governors is shown in Fig. 2. The magnet is composed of iron core T and winding U; the iron core is fastened to outside shell, which is moulded into insulation piece W and serves as a frictional bearing at surface 1 for the governors. Brass collector rings X moulded into insulation piece W are connected to the terminals of the magnet winding, the electrical connection between the magnet winding and outside battery being made through these collector rings and spring brushes Z, Fig. 4. Armature M, Fig. 2, with the governors, rotates with hollow shaft gear C independently of magnet G and its

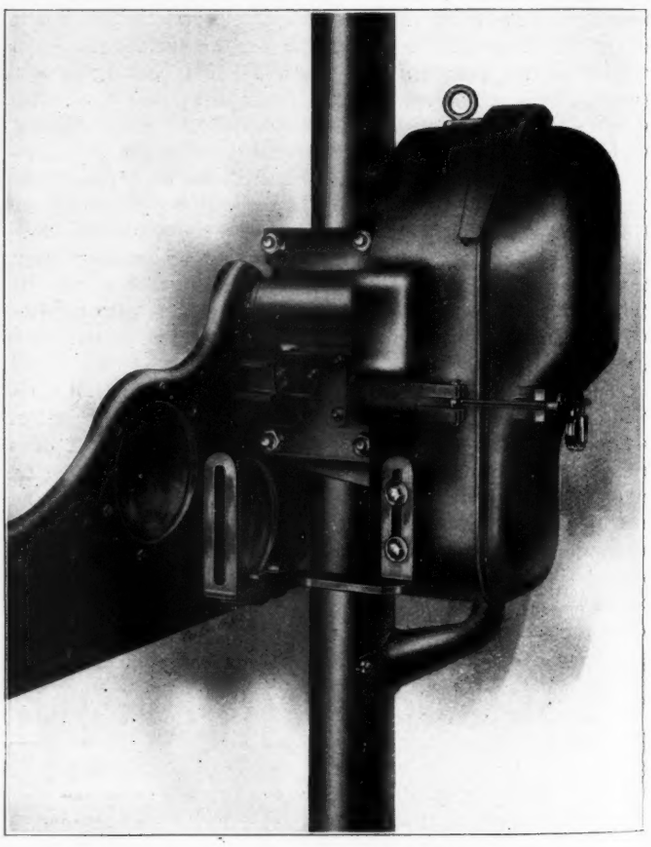


Fig. 7. Top-Post Style K Signal.

shaft. The governors are supported on armature M through lugs b by bronze pins e which are held in place by snap springs d. These snap springs are used on the mechanism in place of cotter pins which are liable to drop out of place if not properly split.

At point F on shaft Q, Fig. 5, a ratchet arrangement shown in Fig. 7 is inserted to prevent shock to the mechanism when the blade grip strikes the stop.

The circuit controller is attached to the blade shaft by di-

rect connections of a most positive character. The contacts which control the operation of the signal blade are made on the principle embodied in our style "G" switch box, with the positive worm gear adjustment, which is a guarantee against slipping cams, and which provides means for the most delicate adjustment.

The counter attachment Y, Fig. 4, is not the least ingenious feature of the mechanism. This provides, in a substantial manner, for registering separately the number of 45-deg. and the number of 90-deg. movements of the signal arm.

This mechanism was designed originally as a top-post type; its adaptability, as such, is evident in its various applications: (1) In a case sulphured or leaded on a pipe post; (2) in a case clamped on top of post, and (3) in a case clamped on the side of a post. The flexibility of design is further demonstrated in its applications as a bottom-post type of signal operating one or two blades in the upper or lower quadrant, in two positions or three position, and pull clear or push clear type. All these types are furnished, moreover, to operate with alternating or direct current. In all these applications, the same principles of operation are employed, in fact, the greater number of the parts are interchangeable in all types.

Since the inception of the style "K" signal these signals have been installed on a large number of the leading railways in the United States and Canada; some of them were subjected to two winters' service test, a larger number had a full year's service test. The signals have operated successfully on railways in every climate, including the rigorous weather of Eastern Canada and the northwestern section of the United States, in sections south of the Mason and Dixon line, and along the eastern and western coasts of this country.

PEASE DIRECT PRINTING PROCESS.

For the past four years the C. F. Pease Company, Chicago, has been developing a process of electric printing which is called the "Pease direct white" or "direct blue line process," which is finding favor for many purposes in the railway service. This process was primarily intended for the engineering department and while it is being used very largely by engineers for diversity of work, in fact for any purpose for which blue prints may be used, it is also meeting with favor with other departments and is being found valuable where a number of duplicate copies are required. Especially is this true in the auditing department for tabulation and the various reports which it is necessary to make from time to time to the Interstate Commerce Commission. The process can also be used by the freight and passenger departments for miscellaneous tariffs where, say, only 200 copies or less may be required.

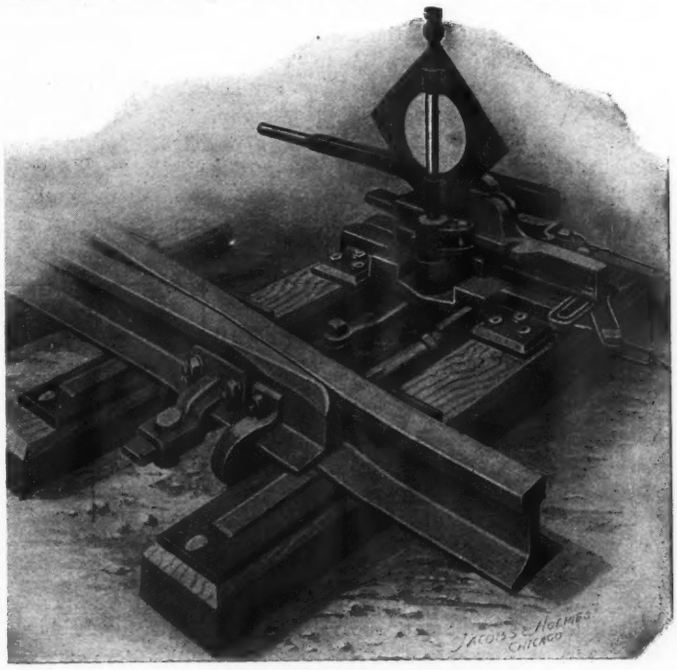
This process can be made on a highly-sized paper, giving good folding and wearing qualities and allowing notations to be made either with pen or pencil. One of the special features is that "every copy is an original." Each is as clear and distinct as every other one and there is no danger of error or misunderstanding by reason of indistinctness. All that is necessary is that the original copy be on transparent cloth or paper and that the work be dense enough for electric printing. The original typewritten copy should be made on a good quality of transparent paper, using a black ribbon and backing up the sheet with a fresh black carbon reversed. With such an original, it is possible by this process to make any number of clear prints. The cost of making these direct blue line prints should not exceed the cost of mimeograph or carbon copies if the work is done by the railway itself.

The equipment is equally suitable for making a high grade of blue prints and when not engaged on the direct blue line work, can be used for this purpose, thus keeping it steadily employed.

The Pease Company has one of these machines in operation at the Coliseum.

PROTECTION OF FACING POINT SWITCHES.

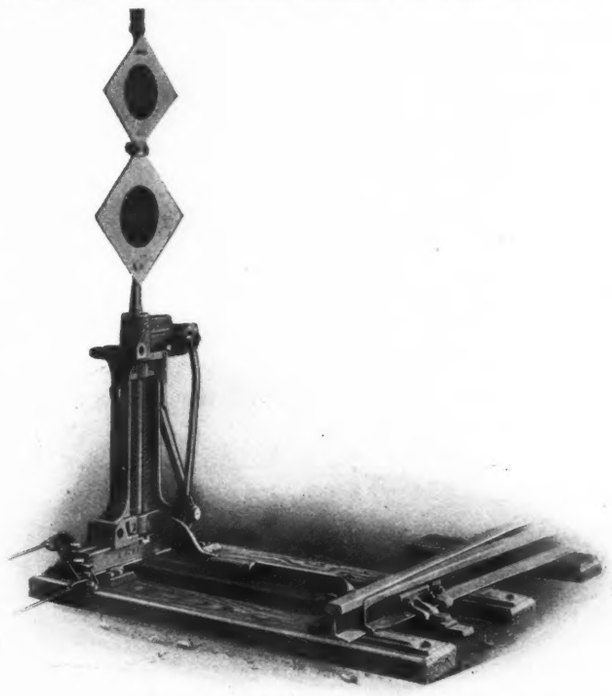
The problem of proper protection for facing point switches is one which has been given much thought in recent years by railway engineers. One of the most certain methods to properly protect the switches is to provide an independent lock rod connecting the switch points to the stand, together



The "Unity" Switch Stand.

with a distant signal, either electrically controlled or wire connected. In the accompanying cuts are shown two styles of switch stands which embody these features. Both of these stands operate the switch, an independent bar lock and a distant signal, with a single lever.

In the high stand, called the "Security," the arrangement of



The "Security" Switch Stand.

parts is such that the raising of the handle out of engagement with a notch or lock throws the distant signal to danger and sets the notch in barlock ready for the movement of the switch. By rotating the handle the bar attached to the switch point engages the distant signal operating bar and simultaneously with movement of switch, locks the distant signal in the position to which it has been set. When the switch has been thrown, all parts are properly interlocked.

If it is desired to do switching while the distant signal is set to danger, the operation is the same as that of an ordinary stand. It is impossible, however, for the switchman to padlock the stand in the main track position without first setting the signal and switch to "safety."

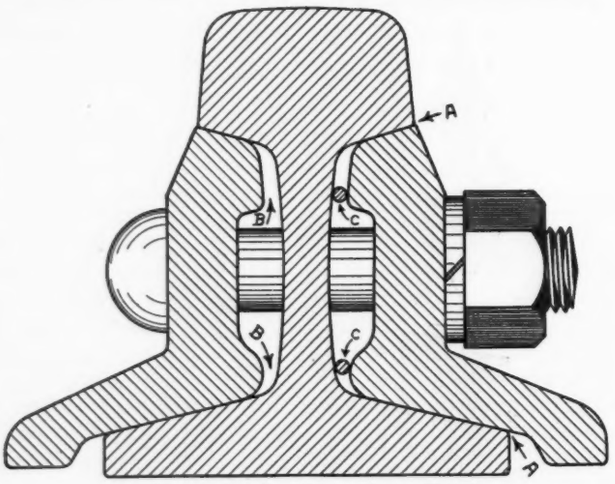
The low stand shown in above cut is called the "Unity" and is a single lever ground throw stand. The lever moves through 180 deg., in the first 90 deg. of which it operates the distant signal and releases the point lock, the final movement throwing the switch. Returning, the first movement closes and locks the switch before the distant signal can be cleared.

The switch may be operated to allow a train to drill in and out of the siding without disturbing the distant signal, which remains at "danger" and protects the movement.

Both of the switch stands described above are designed to operate either wire connected or electrically controlled distant signals, and are being shown by the Morden Frog & Crossing Works, Chicago, at their space in the First Regiment Armory.

A BOND WIRE PROTECTOR.

The purpose of the bond wire protector in general is pretty well known, and it is quite widely used by roads having installations of automatic signals. The manufacturers, however, are calling attention to the point which is not generally thought of in connection with their use and which is of interest to the track man as well as the signal maintainer. To the signal man, the chief feature of bond-wire protectors lies in the fact that they prevent breakage of bond wires, either by malicious persons, by vibration or at the hands of the track men. In the past, and to some extent to-day, signal men have attempted to prevent this breakage by placing the bond wires behind the splice bar next to the rail web, and it is when this action occurs that the matter becomes seriously of interest to the track man and not wholly without interest to the signal man.



P. & M. Bond Wire Protector.

The track man primarily is interested in keeping his angle bars tight. To this purpose the track is patrolled daily by men whose business it is to watch the bolts and tighten them as they come loose. Not infrequently, when bond wires are placed behind the joints, the supervisor or roadmaster has been puzzled by his inability to keep the joints tight, never thinking that the bond wire is responsible.

By reference to the cut it will be seen that the point at which the splice engages the rail head and base is beveled so that by tightening the splice the wear which occurs at "A" may be taken up by the drawing in of the splice bar. To permit this drawing in, a space is left between the bar and the web. This space is smaller at the top and bottom of the bar than at that point at which the bolts pass through. It is, of course, the intention of the signal man that the wires shall remain in the large space near the bolts, but vibration and expansion and contraction cause them soon to work into space "B," in the position shown in the cut. In this position they prevent the proper tightening of the splice bar. The track man may tighten his bolts until the bar comes up against the wire and seem perfectly tight, but let any trains pass over and slightly change the position of the wires and all the connections are loose again.

The signal man is not wholly clear of trouble when the wires are placed behind the splice. Moisture gathers in the space and rapidly corrodes the wires. The wires which work up into space "B" are frequently chewed to pieces by the splice bar, and it is not an uncommon thing to take a wire out of this space and find it worked down almost to the size of a knitting needle for its entire length. On a large number of the roads this trouble has been recognized and the wires placed outside the splice.

Bond wire protectors are in their fifth year of service and their use is extending rapidly, a number of roads having adopted them in the past year as standard. Several forms are shown on a section of rail exhibited by The P. & M. Company, Chicago, at the Coliseum.

ALL-STEEL COALING STATION.

The accompanying cut shows a 150-ton all-steel coaling station recently built for the Chicago, Rock Island & Pacific at Clinton, Okla. The coal is dumped into a concrete pit under the shed at the left of the photograph. From this pit the coal is hoisted up the conveyor tower to the top of the tank. This tower is double with two buckets, one of which goes up as the other goes down. The spouts are so arranged as to feed locomotives on both tracks. Such a steel station has the advantage that it does not burn, its maintenance cost is low and presumably it will have a long life. That these advantages are recognized by many of the railways is attested by the fact that a number of all-steel coaling stations have been built during the last year. The T. W. Snow Construction Company had the general contract for this station, and the steel work was furnished by the Chicago Bridge & Iron Works, Chicago.

All-Steel Coaling Station.